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The report addresses the progress made in the prevention and control of air pollution in 1986. It covers the areas of air quality trends and monitoring, developing of air quality criteria and standards, the status of State implementation plans, the control of stationary and mobile source emissions, enforcement, and litigation. The report is the annual report of the Administrator of EPA to the Congress in compliance with Sections 313, 202(b)(4), and 306 of the Clean Air Act, as amended.

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ANNUAL REPORT OF THE ADMINISTRATOR
OF THE ENVIRONMENTAL PROTECTION AGENCY
TO THE
CONGRESS OF THE UNITED STATES
IN COMPLIANCE WITH
SECTIONS 313, 202(b)(4), AND 306
OF
42 U.S.C. 7401 ET SEQ.
THE CLEAN AIR ACT, AS AMENDED

U.S. ENVIRONMENTAL PROTECTION AGENCY
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Office of Air Quality Planning and Standards
Research Triangle Park, NC 27711

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PREFACE

The Clean Air Act, as amended, authorizes a national program of air pollution research, regulation, and enforcement activities. This program is directed at the Federal level by the U.S. Environmental Protection Agency (EPA). However, primary responsibility for the prevention and control of air pollution continues to rest with State and local governments. The EPA's role is to conduct research and development programs, set national standards and regulations, provide technical and financial assistance to the States, and, where necessary, supplement State implementation programs.

Section 313 of the Clean Air Act requires the Administrator to report on measures taken toward implementing the purpose and intent of the Act. This report covers the period January 1 to December 31, 1986, and describes the issues involved in the prevention and control of air pollution and the major elements of progress toward that goal that have been made during that time. In addition, this report also includes two other EPA reports to Congress required under the Clean Air Act, as amended:

1. Section 306 report on Federal procurement and violating facilities (Chapter VIII), and

2. Section 202(b)(4) report on measures taken in relation to motor vehicle emissions control (Chapter IX).

I. INTRODUCTION AND SUMMARY

A. INTRODUCTION

This report, which has been prepared in order to satisfy the requirements of sections 313, 202(b)(4), and 306 of the Clean Air Act (Act), describes the progress that the Environmental Protection Agency (EPA) has made in the prevention and control of air pollution during 1986. The following paragraphs summarize the contents of the remaining chapters of this report, especially insofar as those chapters illuminate current understanding of air quality problems, controls, and administrative apparatus.

B. AIR QUALITY TRENDS, MONITORING, AND MODELING

Since it takes approximately 1 year to assemble, analyze, and report air quality and emissions data on a national basis, the latest air quality and emissions data available for this report are for the year 1985.

All of the criteria pollutants showed improvements in air quality and emissions between 1976 and 1985. Between 1984 and 1985, all of the pollutants declined with major decreases observed for both carbon monoxide and lead. Specific details on air quality and emissions levels, for each of the pollutants to which national ambient air quality standards (NAAQS) apply, are as follows:

o Annual average ambient total suspended particulate (TSP) levels decreased 24 percent between 1976 and 1985, while TSP emissions decreased 24 percent. Between 1984 and 1985, ambient TSP levels declined 4 percent, while TSP emissions declined 3 percent.

o Annual average ambient sulfur dioxide levels decreased 42 percent between 1976 and 1985, while total sulfur oxide emissions decreased 21 percent. Between 1984 and 1985, ambient sulfur dioxide levels declined 5 percent, while total sulfur oxide emissions declined 3 percent.

o Ambient carbon monoxide levels decreased 36 percent between 1976 and 1985, while total carbon monoxide emissions decreased 21 percent. Between 1984 and 1985, ambient carbon monoxide levels decreased 10 percent. These changes reflect the continuing reductions in carbon monoxide emissions brought about by the Federal Motor Vehicle Control Program, the change in the vehicle mix, and the possible influence of meteorological conditions in some geographic areas.

o Annual average ambient nitrogen dioxide levels decreased 11 percent between 1976 and 1985. Between 1976 and 1985, total nitrogen oxide emissions decreased by 1 percent, but highway vehicle emissions, the source category likely impacting the majority of nitrogen dioxide monitoring sites, decreased by 4 percent. Between 1984 and 1985, ambient nitrogen dioxide levels decreased 2 percent, while total nitrogen oxide emissions increased 2 percent.

- The composite average of the second highest daily maximum 1-hour ambient ozone values decreased 19 percent between 1976 and 1985, while volatile organic compound (VOC) emissions decreased 11 percent. The decrease in ambient ozone levels is complicated by the change in the ozone calibration procedure which took place between 1978 and 1979. In the post-calibration period (1979-1985), ambient ozone levels decreased 10 percent, while VOC emissions decreased 12 percent. The ozone trend in the 1980's shows that the 1980 and 1983 values were higher than those in 1981, 1982, 1984 and 1985. While 1985 levels are similar to 1984 levels, there was a slight improvement of 2 percent in the national composite average between these 2 years.

- Ambient lead levels decreased 79 percent between 1976 and 1985, while lead emissions decreased 86 percent. Between 1984 and 1985, ambient lead levels declined 32 percent, while lead emissions declined 48 percent. This is the largest percentage decrease for any 2 consecutive years.

The EPA promulgated regulations in 1979 which required States to establish and operate air monitoring networks and to report the data to EPA. Two types of permanent stations are provided for in the regulations: State and Local Air Monitoring Stations (SLAMS) and National Air Monitoring Stations (NAMS). The SLAMS, which were designed to meet the overall monitoring requirements of State implementation plan (SIP) activities, were required to meet all provisions of the regulations by January 1, 1983. Through December 1986, 4545 SLAMS monitors were operating in accordance with all requirements of the regulations. The NAMS, which are a subset of the SLAMS network, are designed to provide a national monitoring network as required by section 319 of the Act. Through December 1986, 1325 NAMS monitors were operating in accordance with all requirements of the regulations.

To accompany the proposed revisions to the NAAQS for particulate matter, EPA on March 20, 1984, also proposed amendments to 40 CFR 58 (Air Quality Surveillance and Reporting Regulations). The proposed revisions to Part 58 would establish ambient air quality monitoring requirements for particles nominally 10 micrometers and smaller in diameter (PM_{10}) as measured by a new reference method proposed as Appendix J of 40 CFR Part 50 or an equivalent method. Specialized training was provided by EPA in 1986 to State and local agency personnel on the operation and maintenance of the PM_{10} samplers. Also, in addition to using funds supplied by EPA, the States and local agencies have separately purchased PM_{10} samplers bringing the total number of operating PM_{10} samplers to 877 as of December 31, 1986.

Ambient hydrocarbon data were collected at 23 sites in order to measure nonmethane organic compounds in various cities. Results from this activity will be used in estimating the amount of source control needed to attain the ozone air quality standard.

In the air quality modeling area, EPA evaluated eight short-term, long-range transport models during 1986. This effort resulted from a cooperative agreement between EPA and the American Meteorological Society. In addition, EPA developed a technique for statistically intercomparing the performance of air quality models. This technique will be refined in 1987 and tested for implementation in particular regulatory situations.

In the area of modeling support to air toxics control activities, EPA developed and implemented a simple screening model for relief valve discharges. Efforts were initiated to develop a more refined model for these releases. A major effort during 1986 was the development and adaptation of models for air emissions from facilities handling hazardous wastes.

The oxidant modeling for the New York Metropolitan Area Project was completed in 1986 via cooperative agreements with the States of New York and Connecticut. The program was designed to perform photochemical modeling of the New York metropolitan area, including parts of New Jersey and Connecticut.

The EPA continued its modeling clearinghouse activities to ensure that the use of nonguideline techniques does not lead to inconsistent regulatory decisions. In addition, EPA improved the software for the Chemical Mass Balance receptor model to make the results more informative and the diagnostics easier to use. The EPA also continued to provide technical support and review of ozone model applications using the Empirical Kinetics Modeling Approach (EKMA) in 1986.

The Aerometric Information Reporting System (AIRS) is a new integrated data system being developed by EPA to replace entirely the existing data systems now used by the EPA for storing and retrieving ambient air quality data, stationary source and emissions data, and source compliance data. The AIRS will be composed of an air quality component and a facility data component. In 1986, major efforts continued on the air quality component of AIRS with this segment expected to be fully available for use by EPA Headquarters and Regional Offices by mid-1987 with pilot installations in some States begun by the end of 1987.

In 1986, EPA completed major revisions to emission factors for use by States and others to estimate source emissions and to compile emission inventories. Nearly all the revisions involve the addition of size-specific emission factors with emphasis on PM_{10}.

The EPA distributed guidance in 1986 on procedures for estimating emissions for selected, potentially toxic pollutants. Final reports were distributed for ethylene oxide and chlorobenzenes. Reports are now in preparation for polycyclic organics, polychlorinated biphenyls and benzene.

C. AIR POLLUTION RESEARCH PROGRAMS

In 1986, EPA's research emphasis shifted further toward indoor air pollution research, radon mitigation, and studies on problems associated with complex mixtures of air pollutants. Within the area of criteria pollutant research, priorities included development of VOC control technology, transport of ozone over distances, the health effects of alternative fuels and fuel additives, and the health effects of pollutants for which national ambient air quality standards exist. In the mobile sources area, the focus remained on characterizing evaporative and exhaust emissions from vehicles using alternative fuels such as methanol.

Several advances were made in the area of ambient monitoring in support of the new requirements for measuring PM_{10}. Studies of two instruments were conducted to develop an appropriate Federal Reference Method. In addition, a field monitoring project was initiated in the summer of 1986 to obtain data needed by EPA before considering revisions to the ozone air quality standards.

A number of exposure studies were undertaken in 1986. Studies were completed which describe the amount of ozone removed in the nasal passages and in the lungs of individuals while they breathe ozone. Other studies examined airway resistance occurring in a group of moderately exercising asthmatics exposed to nitrogen dioxide. Two clinical studies of sulfur dioxide were completed in 1986. The first study described the concentration-response range of mildly asthmatic volunteers exposed to various sulfur dioxide concentrations. Another clinical study investigated the effects of a mixture of sulfur dioxide and sulfuric acid mist on mild asthmatics.

A study of lead neurotoxicity in children aged 3 to 7 years was conducted in 1986 which examined the relationship between blood lead level and Stanford-Binet IQ, a measure of cognitive function. An analysis of audiometric data was initiated to investigate the relationship of blood lead levels and hearing thresholds. A study of the neurophysiological effects of lead exposure in monkeys was also completed.

Two promising procedures for sampling source emissions of PM_{10} were field tested and a series of source category reports were completed on major sources of PM_{10} emissions in order to assist States in developing SIP's. Two manuals were completed and distributed to Regional and State personnel involved in inspection and permitting of particulate control systems for electric utility coal-fired boilers.

A major achievement in flue gas desulfurization research was the development of improved calcium sorbents for low-cost retrofit sulfur dioxide control. Up to 95 percent sulfur dioxide removal has been achieved in a pilot plant using duct injection of dry sorbent in a humidified flue gas followed by a fabric filter.

The EPA undertook a number of activities related to air quality modeling in 1986. An improved mechanism was developed to quantify the atmospheric formation of ozone from its precursors. The first generation regional oxidant model was evaluated and improvements are being made. The Regional Lagrangian Model of Air Pollution (RELMAP) was completed in 1986 in support of the proposed PM_{10} air quality standard. A user's guide for the second pollution episodic model (PEM-2) was completed. AROSOL, an urban scale aerosol model, was modified to include two modules for conversion of sulfate, thereby allowing AROSOL to be operated either as a lumped sulfate model or as a model which predicts the particle size and composition distributions. Version Six of the User's Network for Applied Modeling of Air Pollution (UNAMAP) program was disseminated to the user community.

In addition, version one of the Meteorological Processor for Diffusion Analysis was completed, resulting in a format easily used by air quality dispersion models. A complex terrain workshop was held to review the preliminary version of the sulfur dioxide Complex Terrain Dispersion Model.

The EPA continued a number of research efforts to support regulatory activities related to hazardous air pollutants. Final comprehensive health assessment documents for asbestos and nickel were completed and an external review draft on beryllium was released to the public for comment. Monitoring for VOC's through the Toxic Air Monitoring System (TAMS) continued throughout the year at Houston, Boston, and Chicago. Validated TAMS data from these sites were obtained and incorporated into EPA's air toxics data base. An earlier study which used the Total Exposure Assessment Methodology (TEAM) to measure personal exposures and breath concentrations of VOC's generated data from 600 individuals. The data were partially analyzed in 1986. An analysis of the risks of organic chemicals in the home was presented at the annual meeting of the Air Pollution Control Association in Minneapolis. The Total Human Exposure Research Council was formed to enhance communications on research projects concerning human exposures to chemicals, including hazardous air pollutants. In addition, an Interdivisional Air Toxics Study (IATS) was initiated to study the health effects of inhaled hazardous air pollutants (HAP's). Compounds under study were selected based on high production and potential human exposure.

Important advances were made in developing and validating test methods to determine the neurotoxic potential of HAP's. A study to evaluate the visual function effects of sulfolane, an industrial solvent, was completed. More cost effective and better predictive indicators of reproductive dysfunction were studied to evaluate potential HAP's. Two wood stove emission control technologies were studied and final results will be published following the 1986-87 heating season. Progress was made in research on atmospheric formation and fate of toxic air pollutants.

A number of research activities in 1986 were directed toward EPA's mobile source regulatory program. As recommended by EPA's Science Advisory Board, validation of the Simulation of Human Air Pollutant Exposure (SHAPE) and the NAAQS Exposure Model (NEM) began, using field data collected during a carbon monoxide exposure study. Analyses were completed which related carbon monoxide exposure profiles with estimated carboxyhemoglobin (COHb) levels and measurements of carbon monoxide in the breath of subjects. Research was conducted to characterize organic emissions from motor vehicles operated at reduced ambient temperatures.

The EPA initiated several changes in its indoor air research program in 1986 including the establishment of a new indoor air policy staff to assist in guiding indoor air research and decision-making. Work was begun on an extensive bibliography of the world literature on indoor air and total human exposure, emphasizing concentrations measured in indoor microenvironments. The exposure portion of a clinical study of children with parents who smoke was completed. A pilot field study was completed on the mutagenicity of emissions from several in-home combustion sources, including convective and radiant kerosene heaters, gas stoves, fireplaces, and cigarettes. Preliminary studies of organic compound emissions from kerosene space heaters were completed. The results suggested that emissions of carcinogens may be significant for certain heater types under specific operating conditions. Laboratory studies of organic vapor emission rates from selected indoor building materials and consumer products were conducted and reported in 1986.

Field testing to develop and demonstrate low-cost techniques for reducing radon concentrations in homes was continued in 1986. The techniques selected for testing in each home vary according to type of house, foundation, local geology and meteorology, and other factors. A technical manual for installers of radon mitigation techniques was issued in August 1986. A Radon Mitigation Test Matrix was developed and reviewed by EPA's Science Advisory Board.

Initiation of studies on control technology and strategies for controlling stratospheric ozone-depleting substances resulted in identification of sources for which additional studies need to be conducted. National and international workshops were held on control strategies for stratospheric modification. In addition to continued research regarding the potential impact of increased levels of solar UV-B radiation on U.S. agriculture, silviculture, and marine fisheries, work is ongoing on a regulatory impact analysis for possible domestic and international controls on CFC's and other potential ozone-depleting trace gases. These analyses will support later EPA regulatory determinations.

The EPA continued to perform research in a number of areas related to acid deposition. In 1986, acid deposition research produced scientific information on the chemical status of a representative sample of lakes in the eastern United States, and developed a preliminary 1985 manmade emissions data base. The program established a cloud chemistry network to cover the major high altitude forest system in the eastern part of the nation. A dry deposition monitoring network (30 sites) was begun, and significant progress was made in determining the effects of acidic deposition on southern conifer and spruce/fir forests.

The deposition monitoring research program continued to provide the deposition data on wet precipitation through the National Trends Network (NTN). The network consisting of 150 stations operated at full capacity. Since dry deposition may account for a larger proportion of total deposition than wet deposition, implementation of a dry deposition network was begun in 1986 with a five-station dry deposition pilot network.

The EPA continued to improve the field data bases on atmospheric transport, transformation, and deposition of acidic substances in order to develop more scientifically acceptable, yet simplified models, to meet assessment and policy needs. In 1986, the preliminary evaluation of the full Regional Acid Deposition Model (RADM) using the Oxidation and Scavenging Characteristics of April Rains (OSCAR) meteorology and wet chemical deposition data was reported. In addition, EPA conducted research into acid deposition effects on fish and other aquatic organisms and drinking water quality.

Various adverse changes in forest conditions have been observed in the United States since the early 1980's. A joint EPA/U.S. Forest Service research program, the Forest Response Program, was established in 1985 to investigate the extent of damage to forest ecosystems which might be caused by acid deposition, cause and effect relationships, and dose response relationships.

The EPA's materials effects research is directed toward understanding the quantitative relationships between the various forms of acidic deposition and the resulting damage rates to materials and identifying the geographical extent of materials at risk. The materials research program was reconstructed in 1986. A major initiative was the development of a research program to determine the effects of acid deposition on paint/substrate systems.

The EPA continues to develop limestone injection multistage burner (LIMB) technology that is designed to reduce emissions of both sulfur oxide and nitrogen oxide, the two major acid deposition precursors. In 1986, work continued on the development of high surface area sorbents and sorbents treated with "promoters" to improve the sulfur capture ability of the LIMB technology. The design phase of the wall-fired, full-scale LIMB demonstration was completed.

D. DEVELOPMENT OF NATIONAL AMBIENT AIR QUALITY STANDARDS

The 1977 Clean Air Act Amendments require EPA regularly to review and, if appropriate, to revise all of the NAAQS. Reviews of the NAAQS for carbon monoxide and nitrogen dioxide were completed in 1985; reviews of the remaining four NAAQS were in progress in 1986.

In 1984, EPA proposed changes to the NAAQS for particulate matter. The proposal was reviewed at a Clean Air Scientific Advisory Committee (CASAC) meeting in December 1985 and CASAC recommended that because of new data published since the combined particulate matter/sulfur oxide criteria document was prepared in 1981, EPA should prepare addenda to the criteria document and the sulfur oxide and the particulate matter staff papers. The CASAC reviewed the addenda in October 1986 and submitted their final written comments on the particulate matter addenda in December. Final promulgation of the particulate matter standards is planned for the spring of 1987. Activities on the sulfur oxide NAAQS review in 1986 focused on refinements to the exposure analysis for various 1-hour standard alternatives and the preparation and CASAC review of addenda to the criteria document and the staff paper. Revised or reaffirmed sulfur oxide standards are scheduled to be proposed in 1987.

In May 1986, CASAC reviewed a third draft of the criteria document revision for lead and a second draft of the lead staff paper. In April 1986, CASAC reviewed revised drafts of the criteria document for ozone and the ozone staff paper; CASAC completed their review of the criteria document in October 1986.

E. ASSESSMENT AND CONTROL OF TOXIC AIR POLLUTANTS

In 1985, EPA announced its strategy for the control of both routine and accidental releases of toxic air pollutants. Considerable progress was made in 1986 to implement this strategy. In 1986, EPA continued to implement an active program to screen and assess potentially toxic air pollutants for possible regulation under the Act or other environmental authorities. A total of 38 chemicals or emission mixtures were in various stages of assessment at the end of the year. In addition, draft reports were completed for Tier 4 of the National Dioxin Study, a coordinated effort of various EPA programs to assess the potential extent of contamination of the environment with chlorinated dioxin compounds. Tier 4 focuses on combustion sources and deals primarily with emissions to the atmosphere.

National emission standards for hazardous air pollutants (NESHAP) were promulgated in 1986 for arsenic emissions from glass manufacturing, high arsenic feedstock primary copper smelters, low arsenic feedstock primary copper smelters, and radionuclide emissions from uranium mill tailings piles licensed by the Nuclear Regulatory Commission. Work was initiated to develop implementation procedures for facilities subject to the radionuclide NESHAP. Work will continue through 1987 and will lead to full implementation in 1988. Revisions to the vinyl chloride NESHAP were also promulgated. Work continued in 1986 on a source assessment for benzene emissions from gasoline marketing and on promulgation of the NESHAP for coke-by-product plants. Work also continued in 1986 on revising the NESHAP for asbestos and for mercury. The NESHAP development continued in 1986 for chromium emissions from electroplating and industrial cooling towers and for coke oven emissions sources in the iron and steel industry. Work commenced in 1986 on a NESHAP for ethylene oxide, 13 source categories in the organic chemicals industry, perchloroethylene emissions from the dry cleaning industry, emissions from phosphogypsum piles, and a NESHAP for solvent degreasing equipment. The sources of cadmium were still under review at the end of 1986. Decisions on any cadmium source categories which warrant regulation will be made in 1987. In addition, a detailed risk and control technology assessment for municipal waste combustion was initiated in 1986.

Preliminary assessments show that emissions to the air from hazardous waste treatment, storage, and disposal facilities (TSDF's) may pose significant health and environmental risks. Current EPA plans call for development of TSDF regulations in three phases. The first group of standards addresses sources for which EPA can develop standards relatively quickly because similar sources have already been regulated under the Act. These standards address air emission vent and fugitive emissions from some of the treatment devices that will be used to meet the Resource Conservation and Recovery Act land disposal restrictions. The second group of standards, which addresses the bulk of the TSDF sources, is scheduled for proposal in 1988 and final action in 1989. The third group of regulations will cover certain subsets of the seven TSDF source categories for which EPA will likely be unable to develop rules during the second round.

In 1986, EPA continued to pursue that portion of its air toxics strategy that provides State and local air pollution control agencies with funding and technical support to evaluate specific point sources. Sources that are candidates for this program include those that have been identified through the Federal toxic air pollutant assessment program but which do not warrant Federal regulations. This program was initiated in 1984 with a pilot program involving the chemical acrylonitrile, a carcinogen for which the public health risks are limited due to the existence of only a few industrial facilities. Evaluations involving all 26 acrylonitrile facilities in 14 States have been completed and the reports accepted by the appropriate State and local agencies. Control efforts have been initiated in several States based on these evaluations. State evaluations for 9 additional source types were funded in 1986 and evaluations at the State/local level were begun.

In 1986, EPA initiated planning and activities to encourage States to undertake new efforts toward assessing the scope and seriousness of current exposures to the mixtures of air toxic compounds which are believed commonplace in large metropolitan areas. A program was developed which provides funding and technical assistance to States to encourage them to undertake such assessment efforts in at least 30 targeted areas with populations over one million people. Also closely related, activity on several Integrated Environmental Management Projects (IEMP) was continued. These projects, though multimedia in nature, focus a major portion of study on the air toxics aspects of the urban environment. In 1986, efforts were completed for the Philadelphia, Pennsylvania, and Santa Clara, California areas as a result of work in previous years. Initial studies were concluded in the Kanawha Valley, West Virginia, and Baltimore, Maryland. Additional major monitoring efforts will be conducted in Baltimore in 1987. A new IEMP study was also initiated in Denver, Colorado. The EPA also distributed guidance in 1986 on procedures for estimating emissions for selected potentially toxic pollutants. Final reports were distributed for ethylene oxide and chlorobenzenes. Reports are now in preparation for polycyclic organics, polychlorinated biphenyls, and benzene.

The EPA has established a goal of having quality air toxics control programs in every State and major local agency. During 1986, considerable progress was made toward meeting this goal. The progress was in part due to the establishment of a new program to enhance State and local program development. This program uses available grant funds to promote multiyear planning on the part of State and local agencies for building their air toxics capabilities and programs. In 1986, EPA received 63 multiyear development plans from 48 States and 15 local agencies. The major emphasis of the current State and local activities within these plans is now on development of toxics emissions inventories and modifying existing new source review permit systems to incorporate consideration of air toxic concerns. In order to help the current and future implementation of scheduled multiyear development plan activities, EPA expanded its program of technical support in 1986. The EPA developed several technical documents on topics relevant to air toxics, began trial operation of a control technology center, and designed national workshops to assist State and local agencies in the basic aspects of program development and implementation. In addition, the National Air Toxics Information Clearinghouse was significantly expanded through the implementation of a computerized data base.

F. STATUS OF AIR QUALITY MANAGEMENT PROGRAMS

As mentioned earlier, EPA proposed revised NAAQS for particulate matter in 1984 that would apply to a size range of particles nominally 10 micrometers and smaller in diameter (PM_{10}), and an annual total suspended particulate (TSP) secondary standard. In 1985, EPA published a Federal Register notice which solicited public comments on various matters related to implementing the PM_{10} NAAQS. Seventy-two comment letters were received mostly from industry. Public comments were summarized in 1986 and issues identified for resolution. At the end of 1986, EPA was in the process of resolving the issues raised and developing regulations to implement the revised standards.

The EPA continued to analyze the issue of widespread nonattainment of the ozone air quality standard in 1986. A number of regulatory areas were examined which could result in emission reductions due to improvements in the current control program and from various new control initiatives. Building upon analyses conducted in 1986, EPA plans to continue to involve Congressional, State and local government, and industry and environmental representatives in developing a national ozone control strategy. The EPA plans to formally present this policy in 1987.

In 1986, EPA completed a number of actions related to visibility protection. These actions were either promulgations of Federal implementation plans or else approval of State-submitted plans dealing with visibility monitoring and new source review.

In July 1985, EPA adopted revisions to regulations originally promulgated in 1982 which prohibit reliance by stationary sources on stack heights in excess of "good engineering practice" or on any other dispersion techniques in lieu of emission controls. In accordance with the Act, States were given 9 months to review their rules and source emission limitations and to revise their SIP's and resubmit them to EPA as necessary. At the end of 1986, EPA was in the process of reviewing SIP revisions submitted by the States in response to these regulations.

Also in 1986, EPA proposed a new, modified visible emission test method for evaluating compliance with certain types of SIP opacity standards where the State has not specified a test method in the SIP. At the end of 1986, EPA was reviewing the comments submitted in response to the proposal.

The EPA made significant progress in 1986 in carrying out its responsibilities under the Act regarding the preconstruction review of new and modified stationary sources. In 1986, EPA continued to emphasize the importance of high quality transfers to the States of the prevention of significant deterioration (PSD) and new source review programs. As of the end of the year, 44 State and local agencies had either full delegation of the PSD program or a PSD SIP, and 8 more had partial responsibility for the PSD program.

An important related matter of controversy has been the definition of "source" for the purposes of nonattainment new source review since the Act is not clear in this area. In 1986, EPA worked on the development of a policy which will aid the Regions in processing proposed SIP's for which source definition is a problem.

In 1984, EPA proposed to include surface coal mining fugitive emissions when calculating whether a source is major for purposes of new source review. A regulatory impact analysis was prepared on that proposal and was made available for public comment in early 1986. Resolution of this issue is expected in 1987.

The EPA published its final Emissions Trading Policy Statement in December 1986. The policy sets forth detailed criteria under which companies may substitute or "trade" extra emission reductions from sources less costly to control for emissions from sources that have higher control costs. The final policy authorizes the use of environmentally sound bubbles (emission trades between existing sources) in all areas of the country, as an important component of the nation's effort to achieve and maintain air quality standards.

The National Air Audit System (NAAS) was first developed in 1983. The NAAS started operating on a 2-year cycle in 1986 and all State agencies will be audited in the 1986-1987 cycle. A national report covering the results of these audits will be prepared at the end of 1987.

At the end of 1986, EPA and the States had completed rulemaking for 29 of the 36 State plans which implement the NAAQS for lead.

In 1985, EPA initiated a number of studies related to acid deposition implementation issues. These studies, called State Acid Rain (STAR) projects, were to be conducted by individual States although the results could have broad applicability to other States that might be involved in a possible acid rain control program. A total of 37 projects were eventually funded. In 1986, work on the STAR projects continued, and EPA began reviewing and synthesizing available results from the projects. The EPA has also been able to use the preliminary findings and experiences of the STAR projects in evaluating proposed acid rain control legislation, particularly in regard to implementation schedules and requirements. A second national STAR workshop, held in October 1986, provided States the opportunity to present their initial findings and discuss implementation requirements of hypothetical acid rain legislation.

During 1986, EPA continued to support the VOC Reasonably Available Control Technology (RACT) Clearinghouse. The purpose of this clearinghouse is to provide a means by which State and local air pollution control agencies can exchange technical information, minimize duplication of effort and resources, and provide guidance regarding VOC controls for various industrial operations and other sources. The VOC RACT Clearinghouse output takes several forms, including a VOC RACT Clearinghouse Newsletter. During 1986, three newsletters were issued.

In 1986, EPA continued to provide technical training in the abatement and control of air pollution. This training included short course presentations, self-study courses, technical assistance to others who conduct training, and the support of traineeships and fellowships for graduate air pollution training. During 1986, EPA conducted 30 short courses in 20 different subject areas for a total of 852 students. Technical assistance was provided to States and EPA Regional Offices for conducting 27 additional courses reaching a total of 656 students. Also in 1986, 1128 students applied for the 30 self-study courses presently available. As an additional means of developing qualified personnel, EPA supported 17 graduate traineeships/fellowships to employees of State and local air pollution control agencies.

G. CONTROL OF STATIONARY SOURCE EMISSIONS

In 1986, work progressed on the development of emissions standards for those major source categories not yet regulated under new source performance standards (NSPS) and on the revision of various NSPS as appropriate. During 1986, NSPS were promulgated for emissions of particulate matter and nitrogen oxides from the industrial boiler source category. The existing NSPS for basic oxygen process furnaces, asphalt concrete plants, and kraft pulp mills were revised. Standards were proposed for calciners and dryers, plastic business machines, magnetic tape, and sulfur dioxide emissions from industrial boilers. A revision to the existing NSPS was proposed for sewage sludge incineration.

The EPA established the best available control technology/lowest achievable emission rate (BACT/LAER) Clearinghouse several years ago in order to assist State and local air pollution control agencies by promoting the sharing of air pollution control technology information. The primary output of the Clearinghouse is an annual report of information about BACT/LAER determinations made by the various control agencies. The report published in 1986 contains over 1120 BACT/LAER determinations.

H. STATIONARY SOURCE COMPLIANCE

The EPA currently monitors the compliance status of about 32,000 stationary sources of air pollution. Approximately 28,000 of these sources are Class A SIP sources, about 3,000 are NSPS sources, and about 1,000 are NESHAP sources. At the end of 1986, as has been the case since the late 1970's, the compliance rates were high and generally stable. Both Class A SIP sources and NSPS sources had a compliance rate of over 91 percent and NESHAP sources were over 86 percent. In 1986, EPA conducted 2,353 overview inspections of Class A SIP, NSPS, and NESHAP sources.

The Act provides a variety of administrative enforcement mechanisms for dealing with both special situations and relatively easily corrected violations. During 1986, EPA issued immediate compliance orders under section 113(a) of the Act to 117 sources and issued or approved delayed compliance orders under section 113(d) for 11 sources. In addition, there were 71 Federal civil actions filed in 1986 against stationary sources for violations of the Act. As of January 1987, a total of 122 such actions were pending with the U.S. District Courts.

A major focus of the stationary source compliance program is the effort to return to compliance those sources considered to be "significant violators." For fiscal year 1986, EPA identified 647 significant violators pending at the beginning of the fiscal year. By the end of the fiscal year, 511 had been addressed. In addition, 489 significant violators were newly-identified during 1986 and, of these, 144 were addressed by the end of the fiscal year.

In 1984, EPA first issued guidance on the "timely and appropriate" EPA/State enforcement response for significant air violators. In 1986, this guidance was reissued to include NESHAP violators. In 1986, for the second consecutive year, EPA evaluated the implementation of the "timely and appropriate" guidance. The evaluation showed that all Regions have systems in place to monitor the timeliness of enforcement actions after findings of noncompliance. The "timely and appropriate" guidance also requires assessment of penalties under certain circumstances. Evaluation revealed that in 1986 penalties were generally collected by the States and EPA where the guidance requires.

In 1986, EPA continued its major initiative to ensure that demolition and renovation sites are in compliance with asbestos NESHAP regulations. During 1986, EPA and the States received 26,993 asbestos demolition or renovation notifications, conducted 15,060 asbestos inspections, and found 2,179 violations. The EPA issued 454 notices of violation or deficiency, issued 59 administrative actions, and initiated 33 civil actions for violations of asbestos demolition and renovation regulations. Delegated States also conducted a high level of asbestos enforcement actions during 1986. The States issued 535 notices of violation or deficiency, issued 124 administrative orders, and initiated 26 civil actions. In January 1986, the Department of Justice, on behalf of EPA, filed 11 cases nationwide for violations of the asbestos NESHAP in the course of demolitions and renovations. The initiative was designed to heighten public awareness of the dangers of asbestos exposure due to demolitions and renovations and EPA's regulations applicable to these activities.

On July 11, 1984, EPA issued a vinyl chloride NESHAP enforcement strategy which facilitates the development of civil complaints against violators of vinyl chloride regulations. The EPA filed one new civil action during 1986 for violations of the vinyl chloride standards. At the end of 1986, 14 enforcement actions for violation of these standards were in litigation.

The EPA has been conducting pilot programs to improve implementation of its continuous compliance strategy. One of these programs was a 2-year pilot in Virginia on methods to improve the effectiveness and efficiency of the inspection process. Another pilot, conducted primarily in Missouri, evaluated the effectiveness of a continuous emission monitoring system (CEMS) program as a component of a multifaceted compliance monitoring effort. Finally, in 1986, EPA continued pilot programs in Michigan and Colorado to develop more sophisticated methods for targeting compliance monitoring inspections.

A number of significant enforcement actions were concluded in 1986. In one case, the Supreme Court construed the Act as conferring broad inspection powers on EPA. All nine Justices agreed that EPA could hire a commercial photographer to fly over a plant owned by Dow Chemical Company and take pictures. They ruled that regulatory authority generally carries with it the ability to employ all useful modes of investigation. In another action, the court held that the building owner is liable for violations of regulations controlling the release of asbestos from demolition activities, along with the contractor who actually did the demolition work.

Also in 1986, the presiding Administrative Law Judge ruled in favor of EPA in an action in which EPA alleged that International Harvester exceeded Ohio SIP limitations governing VOC emissions at its Springfield truck assembly plant. In March 1986, a consent decree was entered resolving an action which alleged violations by Jefferson Smurfit Corporation of Ohio SIP provisions regulating VOC emissions. The basic terms of settlement were the defendant's agreements to bring its offending operations into compliance by March 31, 1987, by installation of pollution control equipment, and to pay a civil penalty of $120,000. In October 1986, the U.S. District Court for Arizona entered a consent decree resolving Act violations at Phelps Dodge Corporation's Douglas Reduction Works copper smelter in Douglas, Arizona. The smelter achieved compliance with the Act and the Arizona sulfur dioxide and particulate matter SIP limits by permanently ceasing smelting operations on January 15, 1987. In addition, Phelps Dodge was fined $400,000 in civil penalties, and was required to meet stringent interim emissions curtailment requirements.

In June 1986, EPA filed eight civil cases under the Act against metal parts manufacturing and coating facilities located in the Los Angeles area to enforce California SIP emissions limits for VOC's. Six of the eight cases were settled in December 1986. The remaining two cases are expected to be settled early in 1987.

In June 1986, EPA issued its final inspection frequency guidance for stationary sources of air pollution. For the past 2 years, the guidance has been modified in response to both State and EPA Regional concerns about the need for added flexibility, national consistency, and quality. The guidance also freezes any additional changes while it is being implemented.

During 1986, Class A SIP, NSPS, and NESHAP Federal facilities demonstrated a good record of compliance with applicable air pollution regulations. As of the end of 1986, 313 (88 percent) of the 354 operating Federal facilities are in compliance, 12 are meeting schedules that will bring them into compliance, 25 are in violation and not yet on an acceptable schedule, and 4 are of unknown compliance status.

Four facilities were placed on the List of Violating Facilities in 1986. This list is established by section 306 of the Act for the purpose of preventing the Federal government from doing business with facilities which have violated selected sections of the Act.

I. CONTROL OF MOBILE SOURCE EMISSIONS

The EPA's mobile source control program continued work on several areas in 1986 directly aimed at the goal of reducing ground-level ozone levels. One of the key actions was oriented toward controlling excess evaporative emissions through regulation of in-use gasoline volatility. The EPA held a hearing and workshop in 1986 on gasoline volatility. In 1986, EPA also analyzed whether refueling emission controls are necessary and whether the control should be at the gas station or on the vehicle. A third ozone-related action was an advance notice of proposed rulemaking released in 1986 to tighten light-duty truck exhaust hydrocarbon standards.

The EPA undertook three initiatives on air toxics related to vehicle fuels in 1986. One action was to prepare a study of costs and benefits in reducing the amount of sulfur in diesel fuel. Another was to begin development of testing protocols to determine the health effects of fuels and fuel additives and to develop an inventory of current commercially available fuel additive materials. Another was to hold an internal workshop on formaldehyde exposure.

The EPA has established a nationwide fuels enforcement program to ensure that affected retail outlets comply with regulations aimed at protecting the catalytic converters on 1975 and later model year cars. This program includes sampling of the fuel at retail outlets by EPA field inspectors and private or State inspectors under EPA contract in order to measure the fuel's lead content. The EPA conducted 15,000 inspections under this program during 1986.

Also related to lead emissions, EPA's promulgated rule which reduced allowable lead in gasoline from 1.1 grams per leaded gallon to 0.1 gram per leaded gallon took effect January 1, 1986. In addition, in accordance with the Food Security Act of 1985, EPA conducted tests of farm machinery run on leaded, no-lead, low-lead, and additive gasoline. This testing sought to assess the degree of premature wear in engines built to use leaded gasoline exclusively. In anticipation of the elimination of lead in the in-use fuel, EPA proposed elimination of lead in test fuel in 1986.

The EPA mobile source control program began to shift its enforcement efforts from the area of fuel switching during 1986 by instituting a fuel refiner/importer audit program to assure compliance with the lead phasedown regulations. Investigations of 11 refiner facilities were conducted during 1986 and several notices of violations were issued with proposed penalties of over $40 million.

The EPA produced a number of accomplishments in the area of mobile source standard setting during 1986. In anticipation of the development of methanol as an alternative fuel, a Notice of Proposed Rulemaking was published in 1986, which proposed emission standards for methanol-fueled vehicles. In addition, EPA defended its March 1985 heavy-duty diesel engine rulemaking in court. The court upheld the original rulemaking in nearly all respects. Also, EPA continued to promulgate nonconformance penalties for those engine families unable to meet certain standards applicable to a given model year. The EPA also published a study on the economics of trading and banking emissions of particulate matter and oxides of nitrogen from heavy-duty diesel engines in 1986.

One of EPA's key techniques for assuring the compliance of vehicles with the motor vehicle emissions standards is the preproduction certification program. Initiated in 1968, the program involves the engineering review and testing by EPA staff of engine families representing new vehicles which are to be sold in the United States. This procedure identifies and resolves potential problems which could result in excessive in-use emissions. As a result of a series of regulatory reforms implemented over the last several years, the certification process has become a much stronger, flexible, and more efficient program. Effective use of computerization has eliminated redundancy, resulted in administrative streamlining, and eased the procedural burden to the manufacturers, while still retaining the full effectiveness of the program.

In 1986, EPA continued to promote the implementation of vehicle inspection/maintenance (I/M) programs in each locality where it is required by the Act. By the end of the year, 58 of 62 areas had initiated I/M programs. In order to assure that operating I/M programs actually achieve the planned emissions reductions, EPA has initiated a systematic I/M auditing plan. In 1986, EPA audited 13 I/M programs and conducted 6 follow-up audits. In addition to I/M programs, EPA has promoted the implementation of State and local antitampering enforcement programs. By the end of 1986, 32 programs had been implemented.

In order to assure that production vehicles and heavy-duty engines are built in accordance with emissions standards, EPA conducts Selective Enforcement Audit (SEA) test programs at manufacturers' facilities. As a direct result of the SEA program, most light-duty vehicle and heavy-duty engine manufacturers also perform internal quality assurance emission testing of their production. This information is supplied to EPA by manufacturers and provides additional assurance that production vehicles and heavy-duty engines are meeting emission standards. In 1986, EPA conducted 17 SEA's, including 4 at foreign manufacturers' facilities. In addition, the first SEA's of heavy-duty engines were conducted in 1986.

Section 207(c) of the Act authorizes EPA to order the recall of vehicles if a substantial number of any class of vehicles do not conform to emissions standards during their useful lives. During 1986, a total of 1,012,000 vehicles were recalled by or as a result of EPA investigations. Of these vehicles, 435,000 were recalled to correct excessive exhaust hydrocarbon emissions, and 53,000 were recalled to correct excessive evaporative hydrocarbon emissions. In the same period, manufacturers voluntarily recalled an additional 569,000 vehicles to correct emissions problems.

The EPA is also responsible for carrying out programs designed to deter tampering with vehicle emissions control systems or using leaded fuel in vehicles which require unleaded fuel. Tampering enforcement activities increased in 1986, resulting in 73 notices of violation with proposed penalties of $1.4 million. The EPA settled a total of 352 fuels and tampering cases during the year for total penalties of $1.4 million. A critical element of State and local tampering inspections is the availability of replacement emission control components. In 1986, EPA published an interim and proposed enforcement policy for new and used aftermarket catalytic converters which gives specific criteria which must be met by all manufacturers of new and recycled catalytic converters. The EPA is also responsible for assessing whether the Federal emission warranty requirements of sections 207(a) and (b) of the Act are implemented. During 1986, EPA responded to a total of 1175 inquiries. Of these, 188 were complaints specifically related to warranty coverage and were referred to the appropriate vehicle manufacturer for resolution.

The control of emissions from imported vehicles which do not conform to applicable air pollution control regulations has become a major issue in recent years. The importation of these vehicles increased from 1,500 in 1980 to a high of 68,000 in 1985. In 1986, EPA received 36,500 applications for imported vehicles and 32,700 inquiries concerning these automobiles. The decline of imported vehicles in 1986 was primarily due to the less favorable exchange rate between the U.S. dollar and the German mark.

A vigorous enforcement program was undertaken against unskilled and fraudulent emission laboratories. The EPA has been investigating various laboratories to ensure that nonconforming imports have been properly tested to demonstrate conformity with U.S. emission standards. In 1986, EPA successfully prosecuted one laboratory for falsifying test results, resulting in three individual convictions and one corporate conviction. In addition, at the end of 1986, there were three other ongoing investigations which could result in prosecution.

In the area of mobile source-related litigation in 1986, a judgment for $160,000 was issued against a corporation for a violation of section 211 of the Act, which pertains to the regulation of fuels. In addition, cases were initiated against seven defendants in Houston, Texas, for distributing leaded gasoline as unleaded. In another action, EPA proposed a $2,573,090 penalty against a refiner that exceeded allowable lead limits during calendar quarters from October 1, 1983, through December 31, 1984. Also in 1986, EPA cited 16 repair facilities in Indiana, New York, and Colorado for tampering violations. In addition, EPA successfully prosecuted a muffler repair shop for the removal of catalytic converters on 14 vehicles.

J. STRATOSPHERIC OZONE PROTECTION

In 1980 EPA issued an advance notice of proposed rulemaking discussing possible further limits on domestic production of chlorofluorocarbons (CFC's) under section 157 of the Act. This was done in order to lessen potential depletion of stratospheric ozone and thereby lessen the amount of potentially harmful ultraviolet radiation reaching the earth's surface. However, some of the scientific information summarized in that notice was outdated by more recent work in the field, and there have been substantial changes in the research community's understanding of the issue since then. In general, the more recent work demonstrated that possible changes in the stratospheric ozone layer are affected by a more complex array of physical and chemical forces than previously thought. In addition, EPA believes that any decision on further regulation of domestic CFC production or use should be evaluated in the context of possible international regulatory actions. Accordingly, EPA developed a program for further examination and resolution of this issue which it published in January 1986. This program integrates the diverse scientific and economic research being carried on by EPA and by other organizations into a framework for future EPA decision-making on both the domestic and international aspects of this issue.

K. RADON ASSESSMENT AND REMEDIATION

Radon is a radioactive gas produced by the radioactive decay of radium-226, which occurs naturally in almost all soils and rocks. The Reading Prong area of Pennsylvania, New Jersey, and New York are the best known high-radon areas in the United States at this time. However, indoor radon is potentially a widespread problem as high radon levels have been found in many States. Initial efforts of the EPA Radon Action Program in 1985 were concentrated in the Reading Prong with measurement assistance being provided to States in that area. The program was expanded in 1986 in response to increased awareness of the magnitude of the problem and the associated health risks.

The EPA developed a national strategy to assist State governments and the private sector in assessing and reducing health risks due to indoor radon. The goals of the EPA strategy are to determine the national frequency distribution of radon concentrations and identify high risk areas, to remediate exposure in existing structures, to prevent exposure in future construction, and to provide for limited, yet essential, overall Federal program direction and coordination.

L. LITIGATION

During 1986 two highly significant precedent-setting cases involving the Act were decided by the courts. In a major ruling on EPA's obligations under section 115 of the Act, the D.C. Circuit held that two letters forwarded by former Administrator Costle to the Secretary of State and to Senator George Mitchell did not trigger a nondiscretionary duty on the part of the current Administrator to issue calls for SIP revisions in States allegedly contributing to acid deposition in Canada. In a second action, the Supreme Court ruled that EPA acted within its statutory authority under the Act in inspecting a Dow chemical plant by taking aerial photographs. The case is broadly significant because of its ruling that EPA is free to use this inspection technique without transgressing constitutional guarantees against unreasonable searches and seizures.

In another action, a judge in the Eastern District of Michigan issued an order in 1986 enjoining EPA from taking action to withdraw or modify a PSD permit issued by the State of Michigan under delegated federal authority. The court ruled that EPA has no authority to terminate or modify a PSD permit once it is issued except under narrow circumstances.

With one significant exception, the courts uniformly rejected challenges to EPA actions in approving or disapproving particular SIP's plans during 1986. In Bethlehem Steel Corp. v. EPA, the Seventh Circuit rejected challenges to EPA's partial disapproval of Indiana coke oven rules. In Michigan v. Thomas the Sixth Circuit upheld EPA's disapproval of purported RACT requirements for fugitive dust sources, which EPA believed were vague and unenforceable. In Council of Commuter Organizations v. Thomas, the Second Circuit upheld EPA's approval of the New York SIP for ozone and carbon monoxide against a citizen group argument that the state had failed to meet the Act requirement that the existing transportation system meet "basic transportation needs." In New Mexico Environmental Improvement Division v. Thomas, the court upheld EPA's imposition of restrictions on air grants to the State air pollution control agency for failure to submit an adequate I/M program for Albuquerque, against a challenge by the State agency mainly on the grounds that the formula selected by EPA for apportioning the restriction between the State and local agencies was arbitrary and capricious. In Ohio v. EPA, however, the Sixth Circuit, ignoring its own precedents to the contrary, overturned EPA's approval of revised sulfur dioxide SIP limits for two power plants operated by the Cleveland Electric Illuminating Company, on the grounds that EPA had failed to verify modeling results against field data. On EPA's petition for rehearing, the court narrowed its holding to reflect its concern that the model failed adequately to account for lakeshore fumigation effects.

The EPA settled a lawsuit under section 122 of the Act challenging EPA's decision not to regulate polycyclic organic matter. The settlement agreement requires EPA to take a number of regulatory and nonregulatory actions, including conducting a rulemaking under section 111 of the Act for wood stoves, and determining whether to list municipal waste combustor emissions as hazardous air pollutants under section 112.

Finally, in NRDC v. Thomas, the D.C. Circuit largely rejected petitions for review filed by environmental groups and industry challenging the stringency and timing of recently promulgated emission standards for heavy-duty vehicles.

II. AIR QUALITY TRENDS, MONITORING, AND MODELING

This chapter describes current trends in ambient air quality levels (the concentration of a given pollutant in the atmosphere), as well as trends in estimated emissions into the air of various pollutants. In addition, the chapter discusses the topics of air quality monitoring and air quality modeling. Data on ambient air quality levels and emissions are through 1985, the latest year for which EPA has complete statistics.

A. NATIONAL AIR QUALITY AND EMISSION TRENDS

While considerable progress has been made over the years in reducing air pollution levels, millions of people still continue to breathe air that is in violation of the national ambient air quality standards (NAAQS). In 1985, 76.4 million people were living in counties with measured air quality levels that violated the NAAQS for ozone. This compares with 47.8 million people for total suspended particulate, 39.6 million people for carbon monoxide, 7.5 million people for nitrogen dioxide, 4.5 million people for lead, and 2.2 million people for sulfur dioxide.

Nationally, long-term 10-year (1976 through 1985) improvements can be seen for TSP, sulfur dioxide, carbon monoxide, nitrogen dioxide, ozone, and lead. The trend in ozone is complicated by a major drop in measured concentration levels which occurred between 1978 and 1979, largely due to a change in the ozone measurement calibration procedure. Therefore, special attention is given to the period after 1979, because the change in the calibration procedure is not an influence during this time.

Air pollution trends were also examined over the most recent 5-year period (1981 through 1985) to take advantage of the larger number of monitoring sites and the fact that the data from the post-1980 period should be of the highest quality, with sites meeting uniform siting criteria and high standards of quality assurance. Nationally, improvements can be seen for all the pollutants during the 5-year period. Between 1984 and 1985, all of the pollutants declined with major decreases observed for carbon monoxide (10 percent), and lead (32 percent).

All of the ambient air quality trend analyses which follow are based on monitoring sites which recorded data in at least 8 of the 10 years in the period 1976 through 1985. In each of these years, an annual data completeness criteria also had to be met. As a result of these criteria, only a subset of the total number of existing sites are used for trend purposes.

Total Suspended Particulate (TSP) - Annual average TSP levels, measured at 1400 sites, decreased 24 percent between 1976 and 1985. This corresponds to a 24 percent decrease in estimated particulate emissions for the same period. The EPA has found that the TSP data collected during the years 1979-1981 may be biased high due to the glass fiber filter used during these years, and that most of the large apparent 2-year decrease in pollutant concentrations between 1981 and 1982 can be attributed to a change in these filters. As reported in last year's report, there was a slight increase in particulate air quality levels between 1983 and 1984 due to a return of rainfall to more normal levels and an increase in particulate emissions. Between 1984 and 1985, particulate air quality levels declined 4 percent, while emissions declined 3 percent. An examination of regional trends patterns indicates decreases in TSP were evident in most Regions between 1984 and 1985. Two of the EPA Regions, Region V (the Great Lakes States) and Region VI (the South Central States) were among the group of Regions showing the largest particulate air quality improvements and were also the only Regions experiencing increases in precipitation. Correspondingly, it is likely that some of these Regional improvements were due to 1985 being a wetter year.

Sulfur Dioxide - Annual average sulfur dioxide levels measured at 264 sites with continuous sulfur dioxide monitors decreased 42 percent from 1976 to 1985. A comparable decrease of 44 percent was observed in the trend in the composite average of the second maximum 24-hour averages. An even greater improvement was observed in the estimated number of exceedances of the 24-hour standard, which decreased 95 percent. Correspondingly, there was a 21 percent drop in sulfur oxide emissions. The difference between emissions and air quality can be attributed to several factors. Sulfur dioxide monitors are mostly urban population oriented and as such do not monitor many of the major emitters which tend to be located in more rural areas. The residential and commercial areas, where most monitors are located, have shown sulfur oxide emission decreases comparable to sulfur dioxide air quality improvement. Between 1984 and 1985, nationwide average sulfur dioxide levels decreased 5 percent. The decrease in ambient levels corresponds to a 3 percent decrease in sulfur oxide emissions.

Carbon Monoxide - Nationally, the second highest nonoverlapping 8-hour average carbon monoxide levels at 163 sites decreased 36 percent between 1976 and 1985. The median rate of improvement has been about 5 percent per year, but the 1984-85 decrease was twice as large, about 10 percent. The estimated number of exceedances of the 8-hour NAAQS decreased 92 percent between 1976 and 1985. Carbon monoxide emissions decreased 21 percent during the same period. Because carbon monoxide monitors are typically located to identify potential problems, they are likely to be placed in traffic-saturated areas that may not experience significant increases in vehicle miles of travel. As a result, the air quality levels at these locations generally improve at a rate faster than the nationwide reduction in emissions. Between 1984 and 1985, carbon monoxide levels decreased 10 percent. These changes reflect the continuing reductions in carbon monoxide emissions brought about by the Federal Motor Vehicle Control Program, the change in the vehicle mix, and the possible influence of meteorological conditions in some geographic areas.

Nitrogen Dioxide - Annual average nitrogen dioxide levels, measured at 108 sites, increased from 1976 to 1979, and decreased through 1985, except for a slight increase in 1984. The 1985 composite nitrogen dioxide average, however, is 11 percent lower than the 1976 level indicating a downward trend during the overall period. The trend in the estimated nationwide emissions of nitrogen oxides is similar to the nitrogen dioxide air quality trend. Between 1976 and 1985, total nitrogen oxide emissions decreased by 1 percent, and highway vehicle emissions, the source category likely impacting the majority of nitrogen dioxide monitoring sites, decreased by 4 percent. Between 1984 and 1985, the nitrogen dioxide composite average decreased by 2 percent, while the estimated emissions of nitrogen oxides increased by 2 percent. This small year-to-year difference between the ambient levels and the emissions percent change is likely not significant given the relatively low ambient nitrogen dioxide levels.

Ozone - Nationally, the composite average of the second highest daily maximum 1-hour ozone values, recorded at 183 sites, decreased 19 percent between 1976 and 1985. Volatile organic compound (VOC) emissions decreased 11 percent during the same period. Although the 1985 composite average for the 163 trend sites is 19 percent lower than the 1976 average, the interpretation of this decrease is complicated by a calibration change for ozone measurements that occurred in the 1978-79 time period. In the post calibration period (1979 to 1985), ozone levels decreased 10 percent, while VOC emissions decreased 12 percent. The estimated number of exceedances of the ozone standard decreased 38 percent between 1979 and 1985. The ozone trends in the 1980's show that the 1980 and 1983 values were higher than those in 1981, 1982, 1984, and 1985. Previous reports have discussed the likelihood that the higher 1983 levels were influenced by meteorological conditions in that year that were more conducive to ozone formation than conditions in adjacent years. While 1985 levels are similar to 1984 levels, there was a slight improvement of 2 percent in the national composite average between these 2 years.

Lead - The composite maximum quarterly average of ambient lead levels, recorded at 53 urban sites, decreased 79 percent between 1976 and 1985. Lead emissions declined 86 percent during the same period. In order to increase the number of trend sites, the 1981 to 1985 time period was examined. A total of 241 trend sites (1981 to 1985) measured a 50 percent decline in lead levels, corresponding to a 62 percent decrease in estimated lead emissions. Between 1984 and 1985 ambient lead levels declined 32 percent, while lead emissions are estimated to have declined 48 percent. This is the largest percentage decrease for any 2 consecutive years. The decrease in ambient lead levels results from three EPA programs. First, regulations issued in the early 1970's resulted in the lead content of all gasoline being gradually reduced over a period of years. Second, unleaded gasoline was introduced in 1975 for use in automobiles equipped with catalytic control devices. Third, lead emissions from smelters and other stationary sources have been reduced by the TSP and lead control programs.

B. AMBIENT AIR MONITORING

General

Section 110(a)(2)(C) of the Clean Air Act (Act) requires State implementation plans to include provisions for establishment and operation of systems for monitoring ambient air quality. In addition, section 319 of the Act requires the development of uniform air quality monitoring criteria and methods and the establishment of an air quality monitoring system throughout the United States which uses uniform monitoring criteria and methods. To satisfy these requirements, EPA promulgated regulations in 1979 which required States to establish and operate air monitoring stations and report the data to EPA[1]. The two principal types of stations in the State networks are State and Local Air Monitoring Stations (SLAMS) and National Air Monitoring Stations (NAMS). The monitoring stations of the SLAMS and NAMS must adhere to the uniform monitoring criteria described in the regulations. These criteria cover quality assurance, monitoring methods, network design, and probe siting. January 1, 1981, was the deadline by which all NAMS were to meet all of the requirements in the regulations. The SLAMS had until January 1, 1983, to meet all of the provisions in the regulations. Based on 5 years of operating experience with the NAMS and SLAMS networks, some relatively minor modifications of the 1979 regulations were promulgated in the Federal Register in 1985.[2] These modifications were intended to simplify and improve the overall monitoring program required by the Act.

Overall, State and local progress in meeting the requirements of the regulations continues to be excellent. Table 1 shows the status of the SLAMS network at the end of 1986. There are a total of 4545 operating monitors in the network meeting requirements of the regulations. Table 2 shows that 1325 NAMS were in operation and meeting the requirements of the regulations through December 1986. Table 3 lists, by pollutant, the number of SLAMS and NAMS.

Table 1. SLAMS Status through December 1986

	Number of Monitors
Monitors operational through 12/86	4545
Total planned network for 1987*	4400

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*Includes NAMS monitors and reflects small reductions and additions planned by a number of control agencies.

Table 2. NAMS Status Through December 1986

	Number of Monitors
Monitors operational through 12/86	1325
Total planned network for 1987	1297

Table 3. National Summary of Operating Air Monitoring Stations (as of 12/86)

Pollutant	SLAMS (including NAMS)	NAMS
TSP	2350	617
SO_2	524	201
NO_2	227	59
CO	443	117
O_3	599	218
Pb	402	113
TOTAL	4545	1325

Particulate Monitoring

To accompany the proposed revisions to the NAAQS for particulate matter discussed elsewhere in this report, EPA on March 20, 1984, also proposed amendments to 40 CFR 58 (Air Quality Surveillance and Reporting Regulations).[3] The proposed revisions to Part 58 would establish ambient air quality monitoring requirements for particulate matter as measured by a new reference method proposed as Appendix J of 40 CFR Part 50 or an equivalent method. The proposed requirements are comparable to those already established for the other criteria pollutants for which air quality standards have been set. These include requirements for reporting and assuring the quality of ambient particulate matter data, designing monitoring networks, and the siting of samplers. Since most areas of the country did not have particulate matter ambient monitoring data, EPA, in late 1984, procured 662 particulate matter samplers for distribution to State and local agencies. Since then funds have been allocated each year to procure additional particulate matter samplers. Specialized training was provided by EPA to State and local agency personnel on the operation and maintenance of the particulate matter samplers. Also, the States and local agencies have separately purchased particulate matter samplers bringing the total number of operating particulate matter samplers to 877 as of December 31, 1986. The data from these sites will be used by the States in developing particulate matter State implementation plans which will be required upon promulgation of a particulate matter air quality standard.

Nonmethane Organic Compounds Monitoring

During 1986, ambient hydrocarbon data were collected at 23 sites. This was the third consecutive summer of field studies to measure nonmethane organic compounds (NMOC) in various cities. These data are needed to derive NMOC/oxides of nitrogen ratios, an important factor in predicting the effect of control programs to reduce ozone. As in past years, data capture was high and results were reproducible using different measurement techniques. Need for a similar program is envisioned in 1987 and in 1988.

C. AIR QUALITY MODELING

An air quality model is a set of mathematical equations that describes the atmospheric transport, dispersion, and transformation of pollutant emissions. By means of these equations, a model can be used to calculate or predict the air quality impacts of emissions from proposed new sources, emissions from existing sources, or changes in emissions from either of these source categories. These models are of great utility because they provide a means whereby the effectiveness of air pollution controls can be estimated before action is taken.

During 1986, EPA continued its program to evaluate several categories of models. This program was developed in response to recommendations of the American Meteorological Society (AMS) under its cooperative agreement with EPA.[4] The evaluation of eight short-term, long-range transport models was completed[5] in a manner consistent with earlier evaluations of four other categories of models. The results clarified the similarities and differences among several of these models for the two data bases considered. Two of the models appeared to provide somewhat more accurate estimates than the others. A scientific review will be conducted in 1987.

A technique has also been developed for statistically intercomparing the performance of air quality models. The technique makes use of a unique statistical procedure to provide estimates of the degree to which one model outperforms another. The technique addresses both the operational and the scientific component of model evaluation. During 1987, the technique will be refined to allow integration of the operational and scientific components and results from multiple data bases into a single definitive outcome. A protocol will be developed and tested for implementing the procedure in regulatory applications that provides for both generic selection of a best model for widespread use or for case-by-case model selection for use in particular regulatory settings. If feasible, the protocol will incorporate minimum standards of performance that may be used to eliminate poor or noncompetitive models from the selection process.

Activities begun in 1985 to support major new initiatives in the area of air toxics regulation accelerated during 1986. A simple screening model for relief valve discharges was developed and implemented while efforts were initiated to develop a more refined model for such releases. These models address the potentially significant effects of negative buoyancy which is commonly associated with high pressure gas releases. A model for ground level, heavier than air, gas releases was acquired and implemented. A preliminary study comparing the model to alternative models and to observed data was completed. Efforts continued on the development and application of a model for estimating airborne concentrations from mechanical draft cooling tower drift emissions. A major effort during 1986 was the development and adaptation of models for air emissions from facilities handling hazardous wastes. This included the integration of emissions and dispersion models, particularly for large area type sources (e.g., surface impoundments and landfills). Because volatile organic emissions from such facilities are reactive and lead to the formation of ozone over long transport times, regional scale photochemical modeling covering the eastern U.S. was initiated to determine their importance in contributing to the ozone nonattainment problem. A systematic look at projected air toxics modeling needs was initiated during 1986, directed toward planning of future model evaluation efforts.

The Oxidant Modeling for the New York Metropolitan Area Project (OMNYMAP) was completed in 1986 via cooperative agreements with the States of New York and Connecticut. The program was designed to perform photochemical modeling of the New York metropolitan area, including parts of New Jersey and Connecticut. As part of this effort, applications of the Urban Airshed Model (Airshed) were made for 5 high ozone days within the metropolitan area. In general, model predictions of peak ozone values were within plus or minus 30 percent of corresponding concentrations observed at monitoring sites. This level of model performance is consistent with findings from prior Airshed evaluations for St. Louis, Philadelphia, and Tulsa. In addition, several control strategies were tested and the sensitivity of predicted ozone to incoming ozone/precursor transport was examined to a limited extent. The results indicate that the implementation of the emissions reductions, including "extraordinary" measures, would not reduce peak ozone concentrations to below the level of the ozone air quality standards on the days simulated. Moreover, the sensitivity analysis suggests that attainment in the metropolitan area is not likely without a reduction in pollutant transport. The EPA is currently exploring several approaches for further investigations of the impact of transport on control strategies in the Northeast.

Efforts to improve guidance on air quality models and to ensure consistency in their use have also continued.[6] Model Clearinghouse activities were maintained to ensure that use of nonguideline techniques does not lead to inconsistent regulatory decisions. A workshop was held with modeling contacts in EPA's ten Regional Offices and four representative State agencies to improve communications on the use of models and to resolve common problems. Regulatory action on the "Guideline on Air Quality Models (Revised)" was completed with a notice in the Federal Register that incorporated the guideline by reference in regulations on prevention of significant deterioration.[7] The guideline lists the air quality models and data bases required to assess impact and to estimate ambient concentrations due to certain sources of air pollutants. The revision had been the subject of a public hearing and extensive comment. In response to the public comment, a supplemental notice of proposed rulemaking was published that proposes to augment the guideline with four additional models that have unique applications.[8] The public comment period closed in December 1986 and the regulatory action will be completed by mid-1987.

Receptor Model Activities

During 1986, EPA improved the software for the Chemical Mass Balance receptor model to make the results more informative and to make the diagnostics easier to use. The user's manual for the model is being rewritten to reflect these changes. In addition, draft guidance describing a protocol to ensure that a receptor model application is a valid one was completed. A draft protocol to resolve conflicting results between receptor and dispersion models was also completed. The user's manual and two protocols will be finalized and made available for use in regulatory applications during 1987.

Ozone Modeling

During 1986, EPA continued to provide technical support and review of ozone model applications using the Empirical Kinetics Modeling Approach (EKMA). The EKMA is widely used by State and local agencies to estimate emission controls necessary to attain the ambient air quality standard for ozone. Efforts to improve data needed as inputs to the model were continued. A series of draft recommendations related to modeling assumptions, supporting data, and interpretation of results in applications after 1987 were made. During 1987 these draft recommendations will be subject to wider public review.

D. INTEGRATION OF AIR DATA SYSTEMS

The Aerometric Information Reporting System (AIRS) is a new integrated data system being developed by EPA to replace entirely the existing data bases, files, and software now used by the EPA for storing and retrieving ambient air quality data, stationary source and emissions data, and source compliance data. The AIRS will be composed of two relatively separate components (air quality and facility data) but will use common sets of geographical and other codes and draw upon a state-of-the-art data base management system.

In 1986, major efforts continued on the air quality component of AIRS. This segment is expected to be fully available for use by EPA Headquarters and Regional Offices by mid-1987 with pilot installations in some States begun by the end of 1987. Design of the integrated emissions/compliance subsystem proceeded well during 1986.

E. EMISSION FACTOR DEVELOPMENT

In 1986, EPA completed major revisions to emission factors for use by States and others to estimate source emissions and to compile emission inventories. Emission factor information is published and distributed for criteria pollutants in a publication entitled Compilation of Air Pollution Emission Factors.[9] The revisions will be issued in early 1987 as Supplement A to this publication.[10] Nearly all the revisions involve the addition of size-specific emission factors, with emphasis on particles less than 10 microns in diameter (PM_{10}) in anticipation of the PM_{10} ambient air quality standard promulgated during 1987.

The EPA distributed guidance in 1986 on procedures for estimating emissions for selected, potentially toxic pollutants. Final reports were distributed for ethylene oxide and chlorobenzenes. Reports are now in preparation for polycyclic organics, polychlorinated biphenyls and benzene. Issuance of these additional documents is scheduled for 1987, pending the completion of peer review for each document. New work is also planned on improving emission factors for various area sources of toxic air pollutants.

F. REFERENCES

1. 44 FR 27558, May 10, 1979.

2. 50 FR 9538, March 8, 1985.

3. 49 FR 10436, March 20, 1984.

4. D. Fox, "Judging Air Quality Model Performance," Bulletin of the American Meteorological Society, 62(5):599-609, 1981.

5. A. Policastro, et al., "Evaluation of Short-Term Long-Range Transport Models, EPA-450/4-86-016a,b, 1986.

6. "Guideline on Air Quality Models (Revised)," EPA 450/2-78-027R, 1986.

7. 51 FR 32176, September 9, 1986.

8. 51 FR 32180, September 9, 1986.

9. Compilation of Air Pollution Emission Factors, Volume I: Stationary Point and Area Sources, AP-42, U.S. EPA, Research Triangle Park, N.C., September 1985.

10. Supplement A to Compilation of Air Pollutant Emission Factors, Volume I: Stationary Point and Area Sources, AP-42, U.S. EPA, Research Triangle Park, N.C., November 1986.

III. AIR POLLUTION RESEARCH PROGRAMS

A. INTRODUCTION

In support of the Clean Air Act, EPA's Office of Research and Development (ORD) provides health and ecological effects data bases, monitoring and modeling methods, risk assessments, emission reduction and mitigation technologies, and the corresponding quality assurance and technical assistance to develop regulations. In addition, ORD assists States in developing State implementation plans by providing improved monitoring, modeling, and control technology as they become available. In areas where EPA's responsibility is limited to providing technical and public assistance, such as indoor air quality and radon, ORD research provides essential information on risks, prevention, and mitigation.

B. GENERAL AIR POLLUTION RESEARCH ACTIVITIES

In 1986, research emphasis shifted further toward indoor air pollution research, radon mitigation, and studies on problems associated with complex mixtures of air pollutants. Within the area of criteria pollutant research, priorities included development of volatile organic compound control technology, transport of ozone over distances, the health effects of alternative fuels and fuel additives, and the health effects of pollutants for which national ambient air quality standards exist. In the mobile sources area, the focus remained on characterizing evaporative and exhaust emissions from vehicles using alternative fuels such as methanol.

1. Scientific Support to Develop and Review National Ambient Air Quality Standards

(a) Air quality criteria documents

The Clean Air Scientific Advisory Committee of EPA's Science Advisory Board reviewed a second external review draft of the air quality criteria document for ozone in April of 1986. In September 1986, a final ozone document was completed[1] as was a final addendum for the lead air quality criteria document.[2] These documents provide evaluations of the latest scientific knowledge which will serve as the basis for review and possible revision of the ambient air quality standards for these pollutants.

(b) Ambient monitoring

Several advances were made in the area of ambient monitoring in support of the new requirements for measuring particulate matter less than or equal to 10 micrometers in size (PM_{10}). Studies of two instruments were conducted to develop an appropriate Federal reference method). Further testing is being done on these instruments to correct deficiencies.[3,4] A field monitoring project was initiated in the summer of 1986 to obtain data needed by the agency before considering revisions to the ozone air quality standards. This field study made use of new technology developed by EPA to measure non-methane organic compounds in ambient air.[5] The Standard Reference Photometer Network is now in regular use, thus enabling State and local air monitoring agencies to compare their ozone standards with authoritative standards which are maintained and operated under closely controlled conditions. Quality assurance was provided for air programs in an effort to ensure that measurement data are of known accuracy and precision.[6,7,8] A report published in 1986 indicated that improvements have occurred in the precision and accuracy of monitoring data obtained in regional and national measurements.

(c) Ozone and nitrogen oxide studies

A number of controlled human exposure studies were undertaken in 1986. Studies were completed which describe the amount of ozone removed in the nasal passages and in the lungs of individuals while they breathe ozone.[9] These studies provided information which is important in determining the dose of ozone reaching target tissues in the lungs and for risk assessment analyses in man. Other studies examined airway resistance occurring in a group of moderately exercising asthmatics exposed to nitrogen dioxide.[10] Substantial progress was made in a wide-ranging study of the chronic effects of long-term exposure to nitrogen dioxide and ozone. The study focuses on the ability of oxidant gases to cause chronic lung disease, as reflected by biochemical, structural, and functional changes in the lung.

(d) Sulfur dioxide clinical studies

Two clinical studies of sulfur dioxide were completed in 1986. The first study described the concentration-response range of mildly asthmatic volunteers exposed to sulfur dioxide concentrations between 0.25 and 1.0 ppm.[11] Another clinical study showed that exposure to a mixture of sulfur dioxide and sulfuric acid mist did not affect mild asthmatics more than exposure to either chemical alone.[12]

(e) Lead studies

A study of lead neurotoxicity in children aged 3 to 7 years was conducted in 1986 which examined the relationship between blood lead level and Stanford-Binet IQ, a measure of cognitive function. The IQ decreased linearly as blood lead increased.[13] An analysis of audiometric data was initiated to investigate the relationship of blood lead levels and hearing thresholds. Results indicated that the probability of hearing threshold changes increases significantly with increasing blood lead levels at the frequencies tested (0.5, 1.2 and 4.0KHz).[14] A study of the neurophysiological effects of lead exposure in monkeys was also completed. This study, which is part of a larger investigation of the effects of perinatal lead exposure, indicated prenatal or postnatal exposure to lead resulted in abnormal neurophysiological processing of complex auditory stimuli.[15,16,17]

(f) Crop loss studies

Analysis of the ozone data obtained by the National Crop Loss Assessment Network (NCLAN) showed that substantial dollar losses could be attributed to ozone damage. Nineteen manuscripts were published in 1986 on various aspects of the NCLAN findings.[18-36] Planning was completed for the International Conference on Assessment of Crop Loss from Air Pollutants. This conference, to be held in 1987, will include full reports on the NCLAN research.

(g) Visibility studies

In 1986, several studies were completed on the causes of visibility degradation. One study examined the volatility of light-scattering aerosols collected in ambient air samples. The study found evidence that some light-scattering aerosols may volatize from the air sample before actual detection using conventional measurement procedures.[37] In addition, a new approach for selecting chemical and physical rate parameters was developed to be used in a regional air quality model to estimate sourcereceptor relationships.[38] This approach is unique on a regional scale and can be applied to estimate best fit rate constants for the simulation of sulfur transport, transformation, and removal.

2. Scientific Support to Develop New Source Performance Standards (NSPS) and State Implementation Plans (SIP's)

(a) Particulate matter activities

Two promising procedures for sampling source emissions of PM_{10} were field tested. One method involves the use of a modified Hi-Vol sampler with a size selective inlet.[39] The other uses a modified dichotomous sampler.[40] One of these methods will be chosen as the standard, based on its performance during the evaluations. In addition, a series of source category reports were completed on major sources of PM_{10} emissions to assist States in developing SIP's.[41] The Sixth Symposium on the Transfer and Utilization of Particulate Control Technology was held jointly with the Electric Power Research Institute to transfer information and program results to users and other interested parties.[42]

Two manuals were completed and distributed to Regional and State personnel involved in inspection and permitting of particulate control systems for electric utility coal-fired boilers.[43,44] An interactive computer model for electrostatic precipitators was developed which allows prediction of electrical operating conditions and particle collection efficiencies for any arrangement of round wire discharge electrodes.

(b) Flue gas desulfurization activities

A major achievement in flue gas desulfurization research was the development of improved calcium sorbents for low-cost retrofit sulfur dioxide control. Up to 95 percent sulfur dioxide removal has been achieved in a pilot plant using duct injection of dry sorbent in a humified flue gas followed by a fabric filter. A Lime/Limestone Flue Gas Desulfurization Inspection and Performance Evaluation Manual was published for use by Regional and State personnel involved in inspection and permitting of flue gas desulfurization systems for electric utility coal-fired boilers.[45]

(c) Modeling support activities

An improved mechanism was developed to quantify the atmospheric formation of ozone from its precursors. This mechanism will afford increased accuracy in air quality simulation models.[46] The first generation regional oxidant model was evaluated and improvements are being made.[47] When completed, this model will be used to evaluate the impact of various control strategies on ozone air quality.

In support of the proposed PM_{10} air quality standard, the Regional Lagrangian Model of Air Pollution (RELMAP) was completed in 1986.[48] RELMAP simulates ambient concentrations and wet and dry deposition of sulfur dioxide, sulfates, and fine and coarse particles over the eastern U.S. and southeastern Canada. A user's guide for the second pollution episodic model (PEM-2) was completed.[49] Results of an evaluation of the PEM-2, an urban scale particulate model, showed that background concentrations of particles contribute significantly to urban particulate pollution.[50]

AROSOL, an urban scale aerosol model, was modified to include two modules for conversion of sulfate, thereby allowing AROSOL to be operated either as a lumped sulfate model or as a model which predicts the particle size and composition distributions.[51]

Version Six of the User's Network for Applied Modeling of Air Pollution (UNAMAP) program was disseminated to the user community. UNAMAP is a collection of models and data bases on magnetic tape which is made available to users through the National Technical Information Service.

Version One of the Meteorological Processor for Diffusion Analysis (MPDA-1) was completed, resulting in a format easily used by air quality dispersion models.[52] An adjustable buoyancy balloon tracer of atmospheric motion (Phase III) was improved.[53] The tracer was developed to evaluate the accuracy of air pollution transport models and has application throughout the atmospheric sciences. A complex terrain workshop was held to review the preliminary version of the sulfur dioxide Complex Terrain Dispersion Model.[54] Several recommendations emerged from the workshop which will be incorporated into future versions of the model.

3. Scientific Support to Develop Regulations for Hazardous Air Pollutants (HAP's)

(a) Health assessment documents

Final comprehensive health assessment documents for asbestos and nickel were completed.[55,56] An external review draft of a health assessment document on beryllium was released to the public for comment.[57]

Tier I health effects summaries were prepared for ten compounds.[58-67] These documents summarize available scientific literature on the health effects of a compound, thus enabling EPA to ascertain whether or not a comprehensive health effects document is needed for a specific compound.

(b) Ambient measurement techniques

A number of advanced ambient measurement techniques were investigated, such as combined mass spectrometry, gas chromatography/Fourier transform infrared spectrometry, supercritical fluid chromatography, tunable atomic line mass spectrometry and cryogenic concentration. Several techniques were investigated in order to improve surveillance and control of industrial sources. One promising technique involves the use of specially prepared stainless steel canisters, which inhibit reactions with pollutants collected.[68]

(c) Toxic air monitoring system

Monitoring for volatile organic compounds through the Toxic Air Monitoring System (TAMS) continued throughout the year at Houston, Boston, and Chicago. Validated TAMS data from these sites were obtained and incorporated into EPA's air toxics data base. A second monitoring location in each of the above three cities has been selected and monitoring equipment is being installed.[69]

(d) Personal exposure studies

An earlier study which used the Total Exposure Assessment Methodology (TEAM) to measure personal exposures and breath concentrations of volatile organic compounds generated data from 600 individuals.[70] The data were partially analyzed in 1986. Indoor and in-vehicle sources were found to be much more important than outdoor sources, even in the extremely concentrated petrochemical refinery areas of northern New Jersey and Los Angeles. The major source of exposure to benzene and styrene was cigarette smoking. Chloroform exposure was primarily due to shower use. Room air deodorizers and moth crystals were the major sources of exposure to para-dichlorobenzene. Exposure to tetrachloroethylene comes mainly from dry-cleaned clothes. The study results were presented at the annual meeting of the American Chemical Society. An analysis of the risks of organic chemicals in the home was presented at the annual meeting of the Air Pollution Control Association in Minneapolis.[71]

(e) Enhanced communications

The Total Human Exposure Research Council (THERC) was formed to enhance communication on research projects concerning human exposures to chemicals, including hazardous air pollutants (HAP's). An important objective of THERC is to develop a strategic, 5-year plan for all research on human exposure methodology and assessments conducted by EPA. As a first step toward this goal, a paper was published which summarizes total human exposure concepts, and a second paper was published which reviews EPA's research program on total human exposure to environmental pollution.[72,73]

In 1986, ORD conducted a workshop to foster EPA and industry communications with regard to controlling air toxics. Partially as a result of this workshop, prevention reference manuals are being developed which will cover how to evaluate processes and facilities for accidental release potential, detailed descriptions of pertinent controls (prevention, protection, and mitigation), and specific evaluations for individual chemicals.

(f) Health effects studies

An Interdivisional Air Toxics Study was initiated to study the health effects of inhaled HAP's. Compounds under study were selected based on high production and potential human exposure. As part of this effort, studies of p-xylene, toluene, and phosgene exposures were completed.[74-77]

Important advances were made in developing and validating test methods to determine the neurotoxic potential of HAP's. In particular, studies using discrete lesions in the visual cortex are beginning to elucidate the relationships between neural structures in the visual system and individual components of the flash-evoked potential, which is commonly used to measure neurotoxicity.[78] Another significant advance in test method development was provided by studies to evaluate nervous system specific proteins as biochemical markers for neurotoxicity.[79]

A study to evaluate the visual function effects of the industrial solvent, sulfolane, was completed.[80] The results indicated that high dosages were required to produce effects, thereby indicating that the visual system is not particularly sensitive to this compound. These data are in contrast to previous work which has shown that neurotoxic effects such as increased susceptibility to seizures are produced by lower dosages of sulfolane.

More cost effective and better predictive indicators of reproductive dysfunction were studied to evaluate potential HAP's. An evaluation of age dependent gastrointestinal adsorption of Mn_3O_4, which is a combustion product of the fuel additive methylcyclopentadienyl manganese tricarbonyl (MMT), was conducted to evaluate the fate of inhaled particles translocated to the gut. Results indicate higher absorption and retention in young rats than in adults, resulting in greater exposure for younger animals and an increased possibility of toxicity.[81]

Two wood stove emission samples showed a dose-related tumorigenic response in the Sencar Mouse Skin Tumor Initiation/Promotion Assay. These two samples are from an airtight wood stove burning oak or a softwood mixture.

(g) Wood stove control studies

Two wood stove emission control technologies were studied--existing catalytic secondary combustors and advanced noncatalytic secondary combustors. Final results will be published following the 1986-87 heating season. The advanced noncatalytic secondary combustion development work focused on the use of a small secondary heat source to maintain a stable secondary flame at the low, smoldering burn rates commonly encountered in wood stoves. Laboratory tests on experimental units of both types retrofitted into an existing stove show that this technique is capable of reducing carbon monoxide and total hydrocarbons by more than 95 percent.

(h) Atmospheric formation of HAP's

Progress was made in research on the atmospheric formation and fate of toxic air pollutants. A report on the results of a HAP field measurements program was published which summarizes the atmospheric concentrations of a variety of HAP's observed in selected U.S. cities.[82] A study was completed on the mutagenic activity of wood smoke emissions under typical atmospheric conditions.[83] This study indicated that the mutagenicity of wood smoke emissions was enhanced under conditions simulating sunlight. Smog chamber studies which can simulate a variety of atmospheric conditions and can provide information that can be used to predict atmospheric lifetimes and daughter products were conducted on several candidate HAP's in 1986.

(i) Integrated air cancer program

Through the Integrated Air Cancer Program, data collected during 1985/86 sampling in Raleigh, N.C., and Albuquerque, N.M., were analyzed. Two manuscripts were reviewed and submitted for publication. One of these described effective techniques for measuring the mutagenic activities of gas and particulate-phase photo-oxidation products from wood smoke.[84] The other evaluated the effectiveness of specially coated silica gel cartridges for sampling aldehydes and ketones in the air. Bioassay data were used in the source receptor modeling analysis for the first time. Results from the Albuquerque site show that an average of 50 percent of the ambient particulate mutagenicity was from wood stoves and 50 percent from automobiles.[85]

4. Scientific Support to the Mobile Source Regulatory Program

(a) Exposure modeling

As recommended by EPA's Science Advisory Board, validation of the Simulation of Human Air Pollutant Exposure (SHAPE) and the National Ambient Air Quality Standards Exposure Model (NEM) began, using field data collected during a carbon monoxide exposure study. These models predict human exposure frequency distributions by modeling human activity patterns and the concentrations associated with particular microenvironments. A paper was completed which describes preliminary information on the field performance of SHAPE and its validation using the Denver data base.[86] Additional analyses of the Denver data base were conducted to determine the relationship between fixed monitoring stations and microenvironmental carbon monoxide concentrations.[87] Analyses were completed which related carbon monoxide exposure profiles with estimated carboxyhemoglobin (COHb) levels and measurements of carbon monoxide in the breath of subjects.[88] A model for calculating the carbon monoxide concentrations in the passenger compartment of motor vehicles moving in traffic was tested using the field data from the Washington, D.C., microenvironment study.[89-91] A field study was conducted in Honolulu to measure carbon monoxide exposures while people performed such activities as automobile and bus commuting, jogging, shopping, eating in restaurants, and office work.[92]

Exposure to carbon monoxide elevates COHb levels in the blood. COHb, therefore, is a good indicator of carbon monoxide dose level. In 1986, a study was completed which provides evidence for cardiovascular effects at 4 percent and 6 percent COHb levels in angina patients.[93,94] Another study of carbon monoxide toxicity was completed in 1986 which showed that carbon monoxide exposure diminishes hand-eye coordination.[95]

(b) Emissions studies

Research was conducted to characterize organic emissions from motor vehicles operated at reduced ambient temperatures. The results showed that formaldehyde emissions did not increase in idling cars fueled by gasoline or methanol. It is hypothesized, however, that further studies, under actual operating conditions, will show increased formaldehyde levels as temperatures drop. Such studies will be conducted in 1987.

5. Scientific Support to Determine the Impact of the Quality of Global and Microenvironments on Public Health and the Environment

(a) Indoor air activities

The EPA initiated several changes in its indoor air research program in 1986. The ORD and the Office of Air and Radiation (OAR) are working closely to develop a long-range plan for indoor air. The OAR established a new indoor air policy staff to assist in guiding indoor air research and decision-making. A review of EPA's plans for the indoor air research program was conducted by the Science Advisory Board (SAB). The SAB encouraged EPA to proceed with a research needs assessment, the results of which will guide future research for indoor air.

Work was begun on an extensive bibliography of the world literature on indoor air and total human exposure, emphasizing concentrations measured in indoor microenvironments. The bibliography will be completed in 1987. The EPA also developed the computerized Bibliographic Literature Information System (BLIS) to search and retrieve abstracts of the indoor air quality literature rapidly using a personal computer.[96]

Protocols were prepared for a chamber study designed to replicate and extend earlier findings regarding the neurobehavioral and pulmonary physiology effects of inhaling volatile organic compounds. Additional research on the neurobehavioral effects of these compounds was begun in several areas. The exposure portion of a clinical study of children with parents who smoke was completed, as were analyses of nicotine in indoor air, blood, and urine cotinine (a metabolite of nicotine), air and urine mutagenicity, COHb, particulates, and organics. A pilot field study was initiated which examines the levels of nicotine in the children of smoking parents and evaluates indoor levels of nicotine and other pollutants in the homes where the children live. A second pilot field study was completed on the mutagenicity of emissions from several in-home combustion sources, including convective and radiant kerosene heaters, gas stoves, fireplaces, and cigarettes. The data are being analyzed and will be published within a year.

Preliminary studies of organic compound emissions from kerosene space heaters were completed. Measurements were made of products of incomplete combustion, and bacterial mutagenesis bioassays were conducted on emission samples. The results suggested that emissions of carcinogens may be significant for certain heater types under specific operating conditions. Laboratory studies of organic vapor emission rates from selected indoor building materials and consumer products were conducted and reported in 1986. Sources studied include floor adhesive, caulking compound, particle board, acrylic floor wax, moth crystals, and paints. Interlaboratory comparisons of formaldehyde emissions were conducted as part of a long-term effort to standardize emission testing procedures. Several papers on testing procedures and results were presented and published.

A prototype version of a computerized data base on sources of indoor air pollutants was developed and distributed for review by a small group of indoor air quality researchers and the regulatory office in 1986. A revised version will be distributed for general use in 1987.

(b) Radon activities

Field testing for the purpose of developing and demonstrating low-cost techniques for reducing radon concentrations in homes was continued. The techniques selected for testing in each home vary according to type of house, foundation, local geology and meteorology, and other factors. Through 1986, 30 homes in eastern Pennsylvania and 10 homes in Clinton, New Jersey, have had radon reduction techniques installed. Reductions in most homes ranged from 90 percent to over 99 percent. Based largely on the experience in eastern Pennsylvania, a brochure for homeowners and a technical manual for installers of radon mitigation techniques were issued in August 1986.[97,98] These will be updated in 1987, using the results of ongoing field projects in Pennsylvania, New Jersey, and New York. A Radon Mitigation Test Matrix was developed and reviewed by EPA's Science Advisory Board. Initial estimates show a need to perform mitigation studies on about 600 existing houses and 100 new houses. As a result, the Radon Mitigation Demonstration Program was expanded in 1987 to meet these objectives within a reasonable timeframe.

(c) Stratospheric ozone

In addition to continued research regarding the potential impact of increased levels of solar UV-B radiation on U.S. agriculture, silviculture, and marine fisheries, work is ongoing on a regulatory impact analysis for possible domestic and international controls on CFC's and other potential ozone-depleting trace gases. These analyses will support later EPA regulatory determinations. Initiation of studies on control technology and strategies for controlling stratospheric ozone depleting-substances resulted in identification of sources for which additional studies need to be conducted. National and international workshops were held on control strategies for stratospheric modification. A workshop also was held specifically on nitrous oxide (N2O) emissions from combustion.[99] This workshop helped to define analytical approaches for measurement of N2O and examined the relative strength of various emission source sectors. The available data indicate that stationary combustion sources are the major contributors of N2O emissions.

6. Radiation Monitoring and Quality Assurance to Federal, State, and Local Laboratories

Each year, ORD provides technical assistance to the Department of Energy in the form of radiation safety monitoring, long-term hydrological monitoring, a human surveillance investigation program, and maintenance of a radiation data base. The ORD also provides radiochemical analyses of environmental samples for Regions, States, and contractor laboratories. Support to both of these activities continued in 1986 with a stable level of effort.[100-102]

C. ACID DEPOSITION RESEARCH ACTIVITIES

1. Acid Deposition - General

Research on acid deposition is coordinated through the National Acid Precipitation Assessment Program (NAPAP), which is administered by the Interagency Task Force on Acid Precipitation. The term "acid rain" means the atmospheric deposition of acidic or acid-forming compounds in either dry or wet form. These compounds exist in the atmosphere as gases or aerosol particles containing sulfur oxides, nitrogen oxides, hydrogen chloride, sulfuric acid, nitric acid and certain sulfate and nitrate compounds. The objective of acid deposition research is to develop the necessary data to fully understand the sources and characteristics of acid deposition, the extent of damage or potential damage, and the corrective measures that may be used to diminish the problem.

In 1986, acid deposition research produced scientific information on the chemical status of a representative sample of lakes in the eastern United States, and developed a preliminary 1985 man-made emissions data base. The program established a cloud chemistry network to cover the major high altitude forest system in the eastern part of the nation. A dry deposition monitoring network (30 sites) was begun, and significant progress was made in determining the effects of acidic deposition on southern conifer and spruce/fir forests.

2. Long-term Deposition Monitoring Data (Both Wet and Dry) to Provide Trends Analyses, Evaluate Atmospheric Models, and Determine Exposure in Effects Studies

In 1986, the deposition monitoring research program continued to provide the deposition data on wet precipitation through the National Trends Network (NTN). The network, consisting of 150 stations, operated at full capacity. A series of data reports covering the first four years of operation of the deposition were published.

Since dry deposition may account for a larger proportion of total deposition than wet deposition, implementation of a dry deposition network was begun in 1986 with a five-station dry deposition pilot network. A contract was awarded for installation of the first 30 sites of a more extensive network and field evaluations of proposed concentration monitors were conducted.[103]

3. Activities to Improve the Scientific Understanding of Atmospheric Processes

Improvements are needed in both the scientific understanding, and the field data bases on atmospheric transport, transformation, and deposition of acidic substances in order to develop more scientifically acceptable, yet simplified models, to meet assessment and policy needs.

In 1986, the preliminary evaluation of the full Regional Acid Deposition Model (RADM) using the Oxidation and Scavenging Characteristics of April Rains (OSCAR) meteorology and wet chemical deposition data were reported.[104] The gas-phase chemistry module was compared with both smog chamber data and the more complex chemical mechanisms. The RADM cloud processes and aqueous phase chemistry module was subjectively evaluated against limited field data and more complex models. Because of lack of appropriate data, the dry deposition module was not evaluated. Much larger and extensive data bases are required to test the system thoroughly. Several sensitivity tests were also conducted in which emissions in the Ohio Valley were theoretically reduced by 50 percent and 90 percent and resultant calculated deposition patterns were analyzed.

A detailed operational plan and feasibility analysis for the intensive field studies and the atmospheric model evaluation effort were completed.[105] Draft performance evaluation statements and data quality objectives were provided for nine experimental tasks required for the operational and diagnostic model evaluation field studies. The report indicates that the operational evaluation of RADM is feasible and the diagnostic evaluation of the model is currently being ascertained.

The Regional Lagrangian Model of Air Pollution (RELMAP) has been applied and evaluated for the entire year of 1980 as part of the International Sulfur Deposition Model Evaluation (ISDME). Assessments have been made of the sensitivity of the predictions of sulfur dioxide, sulfates, and total sulfur wet deposition to the process rates; i.e., the modeled rates at which sulfur dioxide transforms to sulfates and sulfur dioxide and sulfates wet/dry deposition occur. The RELMAP sensitivity studies also address single-layer versus multilayer model applications.

4. Activities to Improve the Scientific Understanding of the Aquatic Effects of Acid Deposition on Surface Waters, Watersheds, and Aquatic Biota

Acid deposition is believed to be a major contributing factor to chronic depressions of pH and possible episodic depressions in aquatic systems. Effects which may result include effects on fish and other aquatic organisms and drinking water quality. The population-at-risk of surface waters and aquatic biota in the United States is only partially known. Improvements are needed in both the scientific understanding and the field data bases which define the processes affecting (1) the current status of surface waters and watersheds including episodes; (2) the chemical and biological changes to those resources; and (3) the rate of change resulting from current and altered loadings of acidic or neutralizing substances. These improvements will allow the development of more scientifically acceptable, yet simplified relationships and models for assessment and policy needs.

The National Surface Water Survey (NSWS) addresses the current status of resources. Results of Phase I activity are nearing completion with the recent publication of data and analysis of the Eastern Lake Survey[106] and Stream Survey (Pilot), and the imminent release of the report on the Western Lake Survey.[107] The Stream Survey (Mid-Appalachian Region) report will be released in 1987.

The rate of change of systems is being investigated by the Direct/Delayed Response Project. Three different levels of modeling activities will supply target loading predictions by region. Verification of prediction of the Direct/Delayed Response Project will be undertaken by field and pilot level manipulations of watersheds as part of the Watershed Manipulation Project. The research plan for this project was developed and reviewed in 1986 so that manipulations can begin within 1987.

Long-term monitoring provides the ultimate verification of model predictions by producing information on water quality trends, especially in sensitive systems. The Long-term Monitoring Project was evaluated and redesigned based on the results of the Eastern Lakes Survey to maximize its applicability to detecting changes in sensitive surface waters.

5. Activities to Improve the Scientific Understanding of the Terrestrial Effects of Acid Deposition on Forests, Soils, and Watersheds

Various adverse changes in forest condition have been observed in the United States since the early 1980's. Apparently increased forest mortality has been observed in high elevation stands of red spruce and balsam fir. Also there is some indication that annual increment growth is reduced in these stands. These observed symptoms are nonspecific and could be caused by several different factors or combination of factors. Acidic deposition and its associated pollutants have been implicated as causal factors.

A joint EPA/U.S. Forest Service research program, the Forest Response Program (FRP), was established in 1985 to investigate (1) extent of damage to forest ecosystems which might be caused by acid deposition, (2) cause and effect relationships, and (3) dose response relationships. During 1985 and 1986 the FRP established the Spruce-Fir, Southern Commercial, Eastern Hardwoods, and Western Conifer research cooperatives. Also, the National Vegetation Survey was implemented and a Synthesis and Integration Team has been established. All of these activities have produced detailed research plans which have passed peer review.

(a) Spruce-Fir Research Cooperative

Following peer review in March 1986, a meeting with the Federal Management Group was held and, as a result of that meeting and subsequent reprogramming, 21 projects were funded in 1986. These are aimed at addressing the question of extent of forest damage and at investigating most of the major hypotheses of cause and effect related to the impact of atmospheric deposition on forests.

(b) Southern Commercial Forest Research Cooperative

In 1986, three controlled exposure laboratory studies were funded at Texas A&M University, Oak Ridge National Laboratory, and North Carolina State University. Controlled exposure-field research was conducted in 1986 at Oak Ridge and at the Duke Forest Primary Research Site. In mid-March a request for proposals was issued with two objectives: (1) to study plant physiology in natural stands on the Duke Forest and stand representation of the region, and (2) to study the feasibility of field fumigation techniques. Two projects have been identified for funding. Four secondary research sites have been identified and will be established in 1987. Planning for the development of a central testing facility began in 1986 on a site at the Forest Service greenhouse facility in Macon, Georgia.

(c) Eastern Hardwood Research Cooperative

The Eastern Hardwood Cooperative initiated three projects in 1986. These concentrated mainly on the spatial extent and temporal development of adverse changes in forest condition in eastern hardwood species. Also included are studies concerning the effects of atmospheric deposition on physiological and nutritional processes.

(d) Western Conifers Research Cooperative

Seven projects were funded by the Western Conifers Cooperative in 1986. Similar to Eastern Hardwood, the thrust of this cooperative is problem definition. The concentration of effort in 1986 was on questions of the extent of damage with a smaller effort addressing effects mechanisms.

(e) National Vegetation Survey

Fourteen projects were undertaken by the National Vegetation Survey in 1986, exploring the questions of the temporal development and spatial extent of changes in forest condition. These include both analysis of available data, field observations, and two studies along known deposition gradients.

(f) Synthesis and Integration

A computerized data base system was developed to track the outputs and the status of the Forest Response Program projects. The data base will be expanded to include key bibliographic information as well as other pertinent data. Two research projects were initiated. These deal with the assessment of physiological characteristics for use in developing models of whole-tree processes and with the evaluation and development of statistical techniques for the analysis of dendrochronological data.

6. Activities to Improve the Scientific Understanding of the Effects of Acid Deposition on Materials

The materials effects research program is directed toward understanding the quantitative relationships between the various forms of acidic deposition and the resulting damage rates to materials and identifying the geographical extent of materials-at-risk. As a result of major program and project reviews conducted with NAPAP, the materials research program was reconstructed in 1986. A major initiative was the development of a research program to determine the effects of acid deposition on paint/substrate systems.

A preliminary physico-chemical model of acid deposition on galvanized steel was prepared. This demonstrated the ability to predict damage in the field from information gathered in the laboratory. Additional laboratory and field studies are being conducted to refine and test the model. Field studies on other common metals are in progress at five materials exposure sites. Initial results of the field study were published that indicate the sensitivity of metal surfaces to acid deposition changes over time as a corrosion layer is formed. This has led to the development of a model of deterioration based on the formation of a carbonate layer as a rate-controlling step in deposition.

7. Provision of Additional Information to Document the Reliability and Cost-Effectiveness of the Limestone Injection Multistage Burner (LIMB) Control Technology to Reduce Sulfur Oxides and Nitrogen Oxides

The EPA continues to develop LIMB technology that is designed to reduce emissions of both sulfur oxides and nitrogen oxides, the two major acid deposition precursors. The LIMB emission reduction technology is designed to be retrofitable to both large and small existing coal-fired boilers.

In 1986, work continued on the development of high surface area sorbents and sorbents treated with "promoters" to improve the sulfur capture ability of the LIMB technology. The design phase of the wall-fired, full-scale LIMB demonstration was completed. Also, EPA continued the laboratory and pilot-scale research of the LIMB process to improve engineering knowledge of the effects of operating parameters and systems variables associated with nitrogen oxides control and sulfur dioxide capture. In addition, EPA initiated a competitive procurement for a tangentially-fired, full-scale LIMB demonstration.

D. REFERENCES

1. U.S. Environmental Protection Agency. (1986) Air Quality Criteria for Ozone and other Photochemical Oxidants. Research Triangle Park, N.C.: Office of Health and Environmental Assessment, Environmental Criteria and Assessment Office; EPA report EPA/600/8-84/020F. Available from NTIS, Springfield, VA.; PB-87-142949.

2. U.S. Environmental Protection Agency. (1986) Addendum to Air Quality Criteria for Lead: New Findings Concerning Cardiovascular, Fetal, and Postnatal Development Effects. Research Triangle Park, N.C.: Office of Health and Environmental Assessment, Environmental Criteria and Assessment Office; EPA report EPA/600/****/****. Available from NTIS, Springfield, VA.; PB-**-******.

3. Purdue, L., Status Report on Amendments to 40 CFR Parts 50, 53 With Respect to PM_{10}. Environmental Monitoring Systems Laboratory, Research Triangle Park, N.C. 27711 (June 1986) Available directly.

4. Woods, M., et al. "The PM_{10} Sampler Evaluations Program: January 1985 to July 1986." Research Triangle Institute, Box 12194, RTP, NC 27707 (Report on EPA Contract 68-02-3992. Available directly from author.

5. McElroy, F., et al. "A Cryogenic Preconcentration - Direct FID (PDFID) Method For Measurement of NMOC In Ambient Air." EPA report EPA 600/S4-85/063. (January 1986)

6. Rhodes, R.C., et al. "Precision and Accuracy Assessments for State and Local Air Monitoring Networks, 1985": Environmental Monitoring Systems Laboratory, RTP, NC 27711 (September 1986). Available directly.

7. Parr, B.F., et al. "National Performance Audit Program: Ambient Air Audits of Analytical Proficiency 1985": Environmental Monitoring Systems Laboratory, RTP, NC 27711 (September 1986). Available directly.

8. Rhodes, R.C., et al. "Precision and Accuracy Assessments for State and Local Air Monitoring Networks, 1983": EPA publication EPA 600/S4-86/012 (June 1986).

9. Gerrity, T.R., Weaver, R.A., Berntsen, J., House, D.E. and O'Neil, J.J. Extrathoracic and Intrathoracic Removal of Ozone in Tidal Breathing Humans. Submitted to the Journal of Applied Physiology.

10. Horstman, D., Roger, L.J., McDonnell, W., Kehrl H., Seal, E., Chapman, R., and Massaro, E. Pulmonary Effects in Asthmatics Exposed to 0.3 ppm NO2 During Repeated Exercise. Submitted to the American Journal of Respiratory Disease.

11. Roger, L.J., Kehrl, H., Hazucha, M., and Horstman, D. Pulmonary Effects in Asthmatics Exposed to SO_2 During Repeated Exercise. J. Appl. Physiol. 59:784, 1985b.

12. Horstman, D., Roger, L.J., Kehrl, H., and Hazucha, M. Airways Sensitivity of Asthmatics to Sulfur Dioxide. Tox. and Indus. Health 2:289, 1986.

13. Hawk, B.A., Schroeder, S.R., Robinson, G., Otto, D., Mushak, P., Kleinbaum, D., and Dawson, G. Relation of Lead and Social Factors to IQ of Low-SES Children: A partial replication. American Journal of Mental Deficiency, 9:178-182, 1986.

14. Schwartz, J., Otto, D. Blood Lead, Hearing Thresholds, and Neurobehavioral Development in Children and Youth. Archives of Environmental Health, 1987 (in press: to appear in June-July 1987 issue).

15. Laughlin, N., Hecox, K., Boyes, W., and Creason, J. Background Noise Disrupts Electrophysiological Indices of Audiometry Following Neonatal Lead Exposure in Monkeys. Abstract to be published in Teratology, 1987.

16. Molfese, D.L., Laughlin, N.K., Morse, P.A., Linnville, S., and Wetzel, F. Neuroelectrical Correlates of Categorical Perception for Place of Articulation in Normal and Lead-treated Rhesus Monkeys. Journal of Clinical and Experimental Neurophysiology. 8:680-696, 1986.

17. Morse, P.A., Molfese, D.L., Laughlin, N.K., Linnville, S., and Wetzel, F. Categorical Perception for Voicing Contrasts in Normal and Lead-treated Rhesus Monkeys: Electrophysiological Indices. Brain and Language, 30:63-80, 1987.

18. Adams, R.M., Agriculture, Forestry and Related Benefits of Air Pollution Control: A Review and Some Observations. American Journal of Agricultural Economics 86:464-472. 1986.

19. Adams, R.M., S.A. Hamilton and B.A. McCarl. The Benefits of Air Pollution Control: The Case of Ozone and U.S. Agriculture. American Journal of Agricultural Economics 68:886-893, 1986.

20. Amundson, R.G., R.M. Raba, A.W. Schoettle and P.B. Reich. Response of Soybean to Low Concentrations of Ozone: II. Effects on Growth, Biomass Allocation and Flowering. Journal of Environmental Quality 15:161-167, 1986.

21. Cure, W.W., J.S. Sanders and A.S. Heagle. Crop Yield Response Predicted with Different Characteristics of the Same Ozone Treatments. Journal of Environmental Quality 15:251-254, 1986.

22. Garcia, P., B.L. Dixon, J. Mjelde, and R.M. Adams. Measuring the Benefits of Environmental Change Using a Quality Approach: The Case of Ozone and Illinois Cash Grain Farms. Journal of Environmental Economics and Management 13:69-80, 1986.

23. Heagle, A.S., W.W. Heck, V.M. Lesser, J.O. Rawlings, and F.L. Mowry. Injury and Yield Response of Cotton to Chronic Doses of Ozone and Sulfur Dioxide. Journal of Environmental Quality 15:375-382, 1986.

24. Heagle, A.S., V.M. Lesser, J.O. Rawlings, W.W. Heck, and R.B. Philbeck. Response of Soybeans to Chronic Doses of Ozone Applied as Constant or Proportional Additions to Ambient Air. Phytopathology 76:51-56, 1986.

25. Kohut, R.J. The National Crop Loss Assessment Network (NCLAN): An Update of Research Results and a Program Review. pp. 132-143. Evaluation of the Scientific Basis for Ozone/Oxidant Standards. S.D., Lee (ed.). Air Pollution Control Association, Pittsburgh, PA. 1986.

26. Kohut, R.J., R.G. Amundson and J.A. Laurence. Evaluation of Growth and Yield of Soybean Exposed to Ozone in the Field. Environmental Pollution (Series A) 41:219-234. 1986.

27. Kress, L.W., J.E. Miller, H.J. Smith and J.O. Rawlings. Impact of Ozone and Sulfur Dioxide on Soybean Yield. Environmental Pollution (Series A) 41:105-123, 1986.

28. Lefohn, A.S., W.E. Hogsett and D.T. Tingey. A Method for Developing Ozone Exposures that Mimic Ambient Conditions in Agricultural Areas. Atmospheric Environment 20:361-366, 1986.

29. McCarl, B.A., D. Brown, R.M. Adams and J. Pheasant. Linking Farm and Sector Models in Spatial Equilibrium Analysis: An Application to Ozone Standards as They Affect Corn Belt Agriculture. Quantitative Methods for Market Oriented Economic Analysis Over Space and Time. W. Labys, T. Takayama and N. Uri, (eds.). JAI Press, Greenwich, CT., 1986.

30. Olszyk, D.M. and D.T. Tingey. Joint Action of O_3 and SO_2 in Modifying Plant Gas Exchange. Plant Physiology 82:401-405, 1986.

31. Reich, P.B., A.W. Schoettle, R.M. Raba and R.G. Amundson. Response of Soybean to Low Concentrations of Ozone: I. Reduction in Leaf and Whole Plant Net Photosynthesis and Leaf Chlorophyll Contents. Journal of Environmental Quality 15:31-36, 1986.

32. Rodecap, K.D., and D.T. Tingey. Ozone-induced Ethylene Release from Leaf Surfaces. Plant Science 44:73-76, 1986.

33. Taylor, G.E., Jr., D.T. Tingey and C.A. Gunderson. Photosynthesis, Carbon Allocation, and Growth of Sulfur Dioxide Ecotypes of Geranium Carolinianum L. Occologia 68:350-357, 1986.

34. Temple, P.M. Stomatal Conductance and Transpirational Responses of Field-grown Cotton to Ozone. Plant, Cell and Environment 9:315-321, 1986.

35. Temple, P.J., O.C. Taylor and L.F. Benoit. Yield Response of Head Lettuce (Lactuca Sativa L.) to Ozone. Environmental Experimental Botany 20:53-58, 1986.

36. Tingey, D.T. The Impact of Ozone on Agriculture and Its Consequences. *Acidification and Its Policy Implications.* T. Schneider (ed.). Elsevier Science Publishers B.V., Amsterdam. pp. 55-63, 1986.

37. Weiss, R., D. Covert, and W. Wilson, "Evidence for Volatilization of Light Scattering Aerosol Between 50°C and 220°C," Submitted for Publication, *Atmospheric Environment*.

38. Husar, R., D. Patterson, and W. Wilson, "A Semi-Empirical Approach for Selecting Rate Parameters for a Monte Carlo Regional Air Quality Model," Submitted for Publication, *Atmospheric Environment*.

39. Purdue, L., Status Report on Amendments to 40 CFR Parts 50, 53 With Respect to PM_{10}, Environmental Monitoring Systems Laboratory, RTP, NC 27711 (June 1986). Available directly.

40. Woods, M., et al, "The PM_{10} Sampler Evaluation Program: January 1985 to July 1986", Research Triangle Institute, Box 12194, RTP, NC 27707 (Report on EPA Contract 68-02-3992.) Available directly.

41. Streib, E.W., et al, "A Summary of the 1985 EPA National Performance Audit Program on Source Measurements," Environmental Monitoring Systems Laboratory, RTP, NC 27711 (September 1986). Available directly.

42. Proceedings of the Sixth Symposium on the Transfer and Utilization of Particulate Control Technology EPA/600/9-85/031 A, S, C. (December 1986) Available directly.

43. Operation and Maintenance Manual for Electrostatic Precipitators, EPA publication EPA/625/1-86/017 (September 1986).

44. Operation and Maintenance Manual for Fabric Filters. EPA publication EPA/625/1-86/020 (June 1986).

45. Lime/Limestone Flue Gas Desulfurization Inspection and Performance Evaluation Manual, EPA/600/1-86/029 (September 1986).

46. U.S. Environmental Protection Agency, *Evaluation of a Detailed Reaction Mechanism*: Volumes I and II, EPA/600/3-86/031 a and b. Available from NTIS, Springfield, VA. PB86-212404 and PB86-212412, May 1986.

47. U.S. Environmental Protection Agency, *EPA Regional Oxidant Model, ROM 1 Evaluation for 2-4 August 1979*, EPA/600/3-86/032. Available from NTIS, Springfield, VA. PB86-215886, May 1986.

48. U.S. Environmental Protection Agency, *RELMAP: A Regional Lagrangian Model (Version-2)*, EPA/600/8-86/013. Available from NTIS, Springfield, VA. PB86-171394, March 1986.

49. U.S. Environmental Protection Agency, *User's Guide for PEM-2: Pollution Episodic Model (Version 2)*, EPA/600/3-86/040. Available from NTIS, Springfield, VA. PB87-132098, December 1986.

50. U.S. Environmental Protection Agency, Evaluation of the PEM-2 Using the 1982 Philadelphia Aerosol Field Study Data Base, EPA/600/3-86/016. Available from NTIS, Springfield, VA. PB86-167921, March 1986.

51. U.S. Environmental Protection Agency, Urban Aerosol Modeling: Incorporation of an SO_2 Photochemical Oxidation Module in AROSOL, EPA/600/3-86/048. Available from NTIS, Springfield, VA. PB86-242856, August 1986.

52. U.S. Environmental Protection Agency, MPDA-1: A Meteorological Processor for Diffusion Analysis - User's Guide, EPA/600/8-86/011. Available from NTIS, Springfield, VA. PB86-171402, March 1986.

53. U.S. Environmental Protection Agency, Development of Adjustable Buoyancy Balloon Tracer of Atmospheric Motion: Phase II Development of Operational Prototype, EPA/600/3-86/050. Available from NTIS, Springfield, VA. PB87-100525, August 1986.

54. U.S. Environmental Protection Agency, A Workshop Report on the Complex Terrain Model Development Project (February 4-6, 1986), EPA/600/9-86/026. Available from NTIS, Springfield, VA. PB87-100681, September 1986.

55. U.S. Environmental Protection Agency. (1986). Airborne Asbestos Health Assessment Update. Research Triangle Park, NC: Office of Health and Environmental Assessment, Environmental Criteria and Assessment Office: EPA report EPA/600/8-84-003F. Available from NTIS, Springfield, VA; PB-86-2428564/AS.

56. U.S. Environmental Protection Agency. (1986). Health Assessment Document for Nickel. Research Triangle Park, NC: Office of Health and Environmental Assessment, Environmental Criteria and Assessment Office: EPA report EPA/600/8-83-012FF. Available from NTIS, Springfield, VA; PB-86-232212.

57. U.S. Environmental Protection Agency. (1986). Health Assessment Document for Beryllium [External Review Draft]. Research Triangle Park, NC: Office of Health and Environmental Assessment, Environmental Criteria and Assessment Office: EPA report EPA/600/8-84-026B. Available from NTIS, Springfield, VA; PB-86-183944/AS.

58. U.S. Environmental Protection Agency. (1986). Summary Review of the Health Effects Associated with Phenol. Research Triangle Park, NC: Office of Health and Environmental Assessment, Environmental Criteria and Assessment Office: EPA report EPA/600/8-86-003F. Available from NTIS, Springfield, VA; PB-86-178076.

59. U.S. Environmental Protection Agency. (1986). Summary Review of the Health Effects Associated with Ammonia [OAQPS Review Draft]. Research Triangle Park, NC: Office of Health and Environmental Assessment, Environmental Criteria and Assessment Office.

60. U.S. Environmental Protection Agency. (1986). Summary Review of the Health Effects Associated with Chlorine and Hydrogen Chloride [OAQPS Review Draft]. Research Triangle Park, NC: Office of Health and Environmental Assessment, Environmental Criteria and Assessment Office.

61. U.S. Environmental Protection Agency. (1986). Summary Review of the Health Effects Associated with Methyl Isocyanate and Toluene Diisocyanate [OAQPS Review Draft]. Research Triangle Park, NC: Office of Health and Environmental Assessment, Environmental Criteria and Assessment Office.

62. U.S. Environmental Protection Agency. (1986). Summary Review of the Health Effects Associated with Naphthalene [OAQPS Review Draft]. Research Triangle Park, NC: Office of Health and Environmental Assessment, Environmental Criteria and Assessment Office.

63. U.S. Environmental Protection Agency. (1986). Summary Review of the Health Effects Associated with Propylene [OAQPS Review Draft]. Research Triangle Park, NC: Office of Health and Environmental Assessment, Environmental Criteria and Assessment Office.

64. U.S. Environmental Protection Agency. (1986). Summary Review of the Health Effects Associated with Propylene Oxide [OAQPS Review Draft]. Research Triangle Park, NC: Office of Health and Environmental Assessment, Environmental Criteria and Assessment Office.

65. U.S. Environmental Protection Agency. (1986). Summary Review of the Health Effects Associated with Styrene [OAQPS Review Draft]. Research Triangle Park, NC: Office of Health and Environmental Assessment, Environmental Criteria and Assessment Office.

66. U.S. Environmental Protection Agency. (1986). Summary Review of the Health Effects Associated with Xylene [OAQPS Review Draft]. Research Triangle Park, NC: Office of Health and Environmental Assessment, Environmental Criteria and Assessment Office.

67. U.S. Environmental Protection Agency. (1986). Summary Review of the Health Effects Associated with Zinc and Zinc Oxide [OAQPS Review Draft]. Research Triangle Park, NC: Office of Health and Environmental Assessment, Environmental Criteria and Assessment Office.

68. Lewis, Robert G., "Development of New Sampling and Analysis Techniques for Hazardous Air Pollutants in Ambient and Indoor Air," EPA Environmental Monitoring Systems Laboratory, Research Triangle Park, NC, December 1986. Available directly.

69. Evans, Gary F., "Status Report on Sampling Conducted at Three TAMS Locations," EPA Environmental Monitoring Systems Laboratory, Research Triangle Park, NC, December 1986. Available directly.

70. Wallace, L. A., (1986). "Personal Exposures, Indoor and Outdoor Air Concentrations, and Exhaled Breath Concentrations of Selected Volatile Organic Compounds Measured for 600 Residents of New Jersey, North Dakota, North Carolina, and California." In press, Toxicological and Environ. Chem.

71. Wallace, L.A., (1986). "Cancer Risks from Organic Chemicals in the Homes," Paper Presented at APCA Specialty Conference on Risk Assessment, Chicago, April 14-16, 1986.

72. Ott, Wayne R., "Total Human Exposure: An Emerging Science Focuses on Humans as Receptors of Environmental Pollution," Environmental Science and Technology, Vol. 19, No. 10, October 1985, pp. 880-886.

73. Ott, Wayne R., Lance Wallace, David Mage, Gerald Akland, Robert Lewis, Harold Sauls, David Kleffman, Donna Kuroda, and Karen Morehouse, "The Environmental Protection Agency's Research Program on Total Human Exposure," Environment International, Vol. 12, 1986.

74. Bushnell, P.J., and D.B. Peele, Concentration-dependent Conditioned Flavor Aversions Induced by Inhaled P-xylene. Toxicologist 7:252, 1987.

75. Rosen, M.B., K.M. Crofton and N. Chernoff, Postnatal Evaluation of Prenatal. Tox. Lett. 34:223-229, 1986.

76. Hatch, G.E., R. Slade, A.G. Stead, and J.A. Graham, Species Comparison of Acute Inhalation Toxicity of Ozone and Phosgene. J. Tox. Environ. Health 19:43-532, 1986.

77. Franch, S., and G.E. Hatch, Pulmonary Biochemical Effects of Inhaled Phosgene in Rats. J. Tox. Environ. Health 19:413-423, 1986.

78. Dyer, R.S., K.F. Jensen and W.K. Boyes, Focal Lesions of Visual Cortex - Effects on Visual Evoked Potentials in Rats. Experimental Neurology, 95:100-115, 1987.

79. O'Callaghan, J.P., Neurotypic and Gliotypic Proteins as Biochemical Indicators of Neurotoxicity. In: Neurotoxicology, and ed. M.B. Abou-Donia, Oxford University Press, 1987 (in press).

80. Dyer, R.S., W.K. Boyes and B.E. Hetzler, Acute Sulfolane Exposure Produced Temperature-Independent and Dependent Changes in Visual Evoked Potentials. Neurobehavioral Toxicology and Teratology, 8:687-693, 1986.

81. Rehnberg, G.L., J.F. Hein, S.D. Carter, and J.W. Laskey, Age Dependent Changes in Gastrointestinal Transport and Retention of Particulate Manganese Oxide in the Rat. J. Tox. Environ. Health, 16:887-889.

82. U.S. Environmental Protection Agency, Toxic Chemicals in the Environment: A Program of Field Measurements, EPA/600/3-86/047. Available from NTIS, Springfield, VA. PB-86-239910, July 1986.

83. U.S. Environmental Protection Agency, Mutagenic Activities of Wood Smoke Photo-oxidation Products, EPA/600/3-86/049. Available from NTIS, Springfield, VA. PB-86-239837, August 1986.

84. Kleindienst, T.E., P.B. Shepson, E.O. Edney, L.D. Claxton, and L.T. Cupitt, Wood Smoke: Measurement of the Mutagenic Activities of Its Gas-and Particulate-Phase Photooxidation Products. Environ. Sci. Technol. 20:493, 1986.

85. Lewis, C.W., R.E. Baumgardner, L.D. Claxton, J. Lewtas, and R.K. Stevens, The Contribution of Woodsmoke and Motor Vehicle Emissions to Ambient Air Mutagenicity. Submitted to Nature.

86. Ott, Wayne, Jacob Thomas, David Mage, and Lance Wallace, "Validation of the Simulation of Human Activity and Pollutant Exposure (SHAPE) Model Using Paired Days from the Denver, Colorado, Carbon Monoxide Field Study," Atmospheric Environment, in press, 1987.

87. Johnson, Ted, Jim Capel, and Luke Wijnberg, "Selected Data Analyses Relating to Studies of Personal Carbon Monoxide Exposure in Denver and Washington, DC," Report Under EPA Contract No. 68-02-3496. U.S. Environmental Protection Agency, Environmental Systems Laboratory, Research Triangle Park, NC, February 1986. Available directly.

88. Wallace, Lance, Jacob Thomas, David Mage, and Wayne Ott, "Comparison of Breath CO, CO Exposure, and Coburn Model Predictions in the U.S. EPA Washington-Denver CO Study," Atmospheric Environment, in press, 1987.

89. Flachsbart, Peter G., Gregory A. Mack, James E. Howes, and Charles E. Rodes, "Carbon Monoxide Exposures of Washington Commuters," Journal of the Air Pollution Control Association, Volume 37, No. 2, pp. 135-142, February 1987.

90. Flachsbart, Peter G., "Prototypal Models of Commuter Exposure to CO from Motor Vehicle Exhaust," Paper No. 85-39.6 Presented at the 78th Annual Meeting of the Air Pollution Control Association, Detroit, Michigan, June 16-21, 1985.

91. Flachsbart, Peter G., and Clayton Ah Yo, "Test of a Theoretical Commuter Exposure Model to Vehicle Exhaust in Traffic," Paper No. 86-79.4 Presented at the 78th Annual Meeting of the Air Pollution Control Association, Minneapolis, Minnesota, June 22-27, 1986.

92. Flachsbart, Peter G., and Dennis E. Brown, "Merchant Exposure to CO from Motor Vehicle Exhaust at Honolulu's Ala Moana Shopping Center," Paper No. 85-85.3 Presented at the 78th Annual Meeting of the Air Pollution Control Association, Detroit, Michigan, June 16-21, 1985.

93. Sheps, D.S., K.F. Adams, G.M. Goldstein, J.J. O'Neil, D. Horstman, G. Koch, and P.A. Bromberg. Effect of Low Levels of Carboxyhemoglobin on Cardiovascular Function in Patients with Ischemic Heart Disease. Arch. Environ. Health. March/April 1987.

94. Adams, K.F., B. Chattergee, G. Koch, C.J. Price, G. Goldstein, J. O'Neil, and D.S. Sheps, Earlier Onset of Ischemia After Exposure to Low Level Carbon Monoxide in Patients with Ischemic Heart Disease. Accepted for Presentation at American College of Cardiology. Spring 1987. Abstract.

95. Benignus, V.A., K.V. Muller, C.N. Barton, and J.D. Prah, Effect of Low Level Carbon Monoxide on Compensatory Tracking and Event Monitoring. Neurobehav. Toxicol. Teratol. (in press) (May/June issue, 1987).

96. Shackelford, James M., and Wayne R. Ott, "A Users Manual for the Bibliographic Literature Information System," U.S. Environmental Protection Agency, Office of Research and Development, February 11, 1987.

97. U.S. Environmental Protection Agency, "Radon Reduction Methods: A Homeowner's Guide," EPA 625/6-86-005, July 1986.

98. U.S. Environmental Protection Agency, "Radon Reduction Techniques for Detached Houses: Technical Guidance," EPA 625/5-86-019, August 1986.

99. U.S. Environmental Protection Agency, "Workshop on Global Atmospheric Change and EPA Planning," EPA 600/9-86-016, July 1986.

100. Stuart C. Black, et al, "Off-Site Monitoring for the Mighty Oak Nuclear Test," EPA 600/4-86-030, July 1986.

101. R.F. Grossman, et al, "Off-Site Monitoring Report: Radiation Monitoring Around U.S. Nuclear Test Areas, C.Y. 1985," EPA 600/4-86-022, April 1986.

102. A.N. Jarvis, et al, "Annual Report on the Laboratory Radionuclide Intercomparison Studies: July 1, 1984-June 30, 1985, October 1986. (Environmental Monitoring Systems Laboratory, Las Vegas, NV.)

103. Report: Siting Selection for Dry Deposition Network, December, 1985.

104. Preliminary Evaluation Studies with the Regional Acid Deposition Model (RADM), February, 1986.

105. Regional Eulerian Model Field Study and Evaluation: Proposed Management and Technical Approaches, August, 1986.

106. Characteristics of Lakes in the Eastern United States, Volume I, II, III; EPA 600/4-86/007 a, b and c; June 1986.

107. National Surface Water Survey: National Stream Survey Phase I - Pilot Survey; EPA 600/4-86/026.

IV. DEVELOPMENT OF NATIONAL AMBIENT AIR QUALITY STANDARDS

A. DESCRIPTION OF ACTIVITIES

The 1977 Clean Air Act Amendments require EPA regularly to review and, if appropriate, to revise all of the national ambient air quality standards (NAAQS). Reviews of the NAAQS for carbon monoxide and nitrogen dioxide were completed in 1985; reviews of the remaining four NAAQS were in progress in 1986.

On March 20, 1984, EPA proposed changes to the NAAQS for particulate matter (PM)[1]. The EPA proposed to replace the current 24-hour and annual primary (health-related) standards for total suspended particulate matter (TSP) with standards that include only those particles less than 10 micrometers in diameter (PM_{10}). The EPA proposed to establish an annual secondary (welfare-related) TSP standard and to revoke the current 24-hour secondary standard. The EPA also solicited public comment on the option of making the secondary standards equivalent in all respects to the proposed primary standards. The proposal was reviewed at a Clean Air Scientific Advisory Committee (CASAC) meeting in December 1985 and CASAC recommended that because of new data published since the combined PM/sulfur oxides criteria document was prepared in 1981, EPA should prepare addenda to the criteria document and the sulfur oxides and the PM staff papers. The CASAC also concluded that the available data do not support a TSP-based secondary standard. The CASAC reviewed the addenda in October 1986 and submitted their final written comments on the PM addenda in December.[2,3] Final promulgation of the PM standards was completed in 1987.

Activities on the sulfur oxide NAAQS review in 1986 focused on refinements to the exposure analysis for various 1-hour standard alternatives and the preparation and CASAC review of addenda to the criteria document and the staff paper (see preceding paragraph on PM).[2] Revised or reaffirmed sulfur oxide standards are scheduled to be proposed in 1987.

In May 1986, CASAC reviewed a third draft of the criteria document revision for lead and a second draft of the lead staff paper. The CASAC completed their review of the criteria document but had significant comments on the exposure analysis portion of the staff paper.[4] The CASAC will review a revised draft of the staff paper in late 1987.

In April 1986, CASAC reviewed revised drafts of the criteria document for ozone and the ozone staff paper; CASAC completed their review of the criteria document in October 1986.[5] On the staff paper, issues were raised as to whether a longer-term standard could or should be set to protect against chronic health effects and effects on vegetation.

B. REFERENCES

1. 49 FR 10408, March 20, 1984.
2. "Second Addendum to Air Quality Criteria for Particulate Matter and Sulfur Oxides (1982): Assessment of Newly Available Health Effects Information," EPA-600/8-86-020F, December 1986.
3. "Review of the National Ambient Air Quality Standards for Particulate Matter: Assessment of Scientific and Technical Information," (Addendum to the 1982 OAQPS Staff Paper), EPA-450/5-86-012, December 1986.
4. "Air Quality Criteria for Lead," EPA-600/8-83-028 aF thru dF, October 1986.
5. "Air Quality Criteria for Ozone and Other Photochemical Oxidants," EPA-600/8-84-020 aF thru eF, August 1986.

V. ASSESSMENT AND CONTROL OF TOXIC AIR POLLUTANTS

A. INTRODUCTION

In 1985, EPA announced its strategy for the control of both routine and accidental releases of toxic air pollutants.[1] The following sections discuss the activities and progress made in 1986 to implement this strategy.

B. ASSESSMENT AND REGULATORY DECISIONS

In 1986, EPA continued to implement an active program to screen and assess potentially toxic air pollutants for possible regulation under the Clean Air Act or other environmental authorities. As shown in Table V-1, 38 chemicals or emission mixtures were in various stages of assessment at the end of 1986. Decisions not to pursue a regulatory program directed specifically at phenol[2] and certain nickel compounds[3] were published in 1986. Decisions on whether to regulate 10-12 additional pollutants are expected in 1987.

In 1986, draft reports were completed for Tier 4 of the National Dioxin Study, a coordinated effort of various EPA programs to assess the potential extent of contamination of the environment with chlorinated dioxin compounds. Tier 4 focuses on combustion sources and deals primarily with emissions to the atmosphere. Summary reports were completed for review by the Science Advisory Board (SAB) in August 1986. Final technical reports reflecting SAB and other comments are to be completed and released in early 1987.

C. FEDERAL REGULATORY PROGRAM - STATIONARY SOURCES

1. National Emission Standards for Hazardous Air Pollutants (NESHAP)

- Arsenic - The NESHAP for glass manufacturing, high arsenic feedstock primary copper smelters, and low arsenic feedstock primary copper smelters were promulgated in August 1986.[4]

- Benzene - Work continued in 1986 on a source assessment for benzene emissions from gasoline marketing and on promulgation of the NESHAP for coke by-product plants.

- Asbestos - Work continued on revising the asbestos NESHAP during 1986. The revision will cover the demolition and renovation provisions and is scheduled for proposal in early 1987.

- Mercury - Work continued in 1986 on the revision of the mercury NESHAP. Promulgation is planned for early 1987.

- Vinyl chloride - Revisions to the vinyl chloride NESHAP were promulgated in September 1986.[5]

- Chromium - During 1986, NESHAP development continued for chromium emissions from electroplating and industrial cooling towers. Regulations to prohibit the use of chromium in comfort cooling towers are being considered under the authority of the Toxic Substances Control Act. Other chromium sources still under consideration for NESHAP include utility boilers, industrial boilers, chromium chemical manufacturing, steel production, refractory manufacturing, sewage sludge incinerators, municipal incinerators, cement manufacturing, chromite ore refining, and ferrochromium production.

- Coke oven emissions - Standards development work continued in 1986 for coke oven emissions sources in the iron and steel industry. A proposed NESHAP for coke oven emissions is planned for 1987.

- Ethylene Oxide - Work commenced in 1986 on a NESHAP for commercial sterilization.

- Hazardous Organic NESHAP (HON) - The HON is an accelerated NESHAP development effort that will cover eight organic compounds (ethylene oxide, methylene chloride, ethylene dichloride, perchloroethylene, trichloroethylene, butadiene, chloroform, and carbon tetrachloride) for which an intent to list under either section 112 of the Clean Air Act or section 4(f) of the Toxics Substance Control Act has been published. The HON will cover 13 source categories in the organic chemicals industry. Publication of a proposed rule is scheduled for 1987.

- Perchloroethylene - Work commenced in 1986 on a NESHAP for the dry cleaning industry.

- Radionuclides - Standards were promulgated for Nuclear Regulatory Commission-licensed uranium mill tailings piles.[6] Work continued on studying emissions from phosphogypsum piles. In 1986, EPA initiated the development of implementation procedures and guidance for the five radionuclide NESHAP. The program consists of three elements: (1) completion of reserved sections of the NESHAP rules, (2) development of guidance and criteria for the Regions and States, and (3) initial implementation assistance. This initial program will be fully in place in 1988. Post-1988 efforts will concentrate on a national data base, assistance to the Regions and States, generic guidance and oversight, training programs, and special studies.

- Solvent Degreasing - Work commenced in 1986 on a NESHAP for solvent degreasing equipment. The NESHAP will address emissions of perchloroethylene, trichloroethylene, and methylene chloride.

- Cadmium - The sources of cadmium were still under review at the end of 1986. Decisions on any source categories which warrant regulation will be made in 1987. The categories under consideration are primary cadmium smelters, lead smelters, copper smelters, pigments manufacturing, stabilizers manufacturing, and zinc and zinc oxides production.

- Municipal Waste Combustion (MWC) - A detailed risk and control technology assessment was initiated in 1986. Emissions of concern from MWC are particulates (including chromium and cadmium), acid gases, and organic compounds (including dioxin and polycyclic organic matter). A regulatory decision is scheduled in 1987.

2. Hazardous Waste Treatment, Storage, and Disposal Facilities (TSDF)

In November 1984, the Resource Conservation and Recovery Act (RCRA) was reauthorized. Section 3004(n) of the reauthorization states that not later than 30 months after the date of enactment (i.e., May 1987) the Administrator shall promulgate such regulations for the monitoring and control of air emissions at hazardous waste TSDF's as may be necessary to protect human health and the environment. Air emission sources of concern include surface impoundments, landfills, land treatment units, waste piles, wastewater treatment systems, pretreatment units, and transfer, storage and handling operations. The number of TSDF facilities is currently estimated at between 2,000 - 3,000.

Preliminary assessments of the industry show that TSDF's may pose significant health and environmental risks to the air. Emissions of volatile organic compounds (VOC's), which lead to ozone formation, may be as high as 10 percent of the total nationwide VOC emissions. In addition, cancer incidence from toxic compounds may be as high as 240 cases per year. There is a great deal of uncertainty in these estimates, and a better understanding will be gained over the course of the regulatory development process.

Current plans call for development of TSDF regulations in three phases:

° The first group of standards addresses sources for which EPA can develop standards relatively quickly because similar sources have already been regulated under the Clean Air Act. These standards address air emission vent and fugitive emissions from some of the treatment devices that will be used to meet the RCRA land disposal restrictions. The standards were proposed in early 1987.

° The second group of standards, which addresses the bulk of the TSDF sources, is scheduled for proposal in early 1988 and final action in 1989.

° The third group of regulations will cover certain subsets of the seven TSDF source categories for which EPA will likely be unable to develop rules during the second round. These include dewatering devices (belt presses, filter presses, and centrifuges) and waste fixation in the pretreatment source category and operations associated with containers (filling, emptying, cleaning, etc.). Less data exist on these sources to quantify the extent of the problem or to address the solution. In addition, the land ban rules being developed under other sections of RCRA will require treatment before disposal of hazardous wastes. This program is expected to cause major shifts in the TSDF industry and could cause new sources of air pollution which need to be addressed as the industry develops new treatment technologies. Work on the third group of TSDF's is expected to begin in 1988.

D. MOBILE SOURCES

(Mobile source activities related to air toxics are described in Chapter IX of this report.)

E. SPECIFIC POINT SOURCES

In 1986, EPA continued to pursue that portion of its overall strategy to control emissions of air toxics that provides State and local air pollution control agencies with funding and technical support to evaluate specific point sources. Sources that are candidates for this program include those that have been identified through the Federal toxic air pollutant assessment program but which do not warrant Federal regulations. This program was initiated in 1984 with a pilot program involving the chemical acrylonitrile, a carcinogen for which the public health risks are limited due to the existence of only a few industrial facilities. Evaluations involving all 26 acrylonitrile facilities in 14 States have been completed and the reports accepted by the appropriate State and local agencies. Using the completed reports, State and local agencies have released the information to the public and are making regulatory decisions and recommendations. The State of Ohio, with 6 facilities, has concluded their acrylonitrile effort with a commitment to develop technology-based regulations covering process emissions, leaks, and emissions from storage tanks. Facilities in Iowa, West Virginia, South Carolina, and Virginia have initiated controls through consent decrees, adherence to State ambient guidelines, and permit modifications. For certain acrylonitrile facilities in Connecticut, Delaware, Alabama, Texas, and California, the States concluded after evaluation that existing controls were either adequate or represented state-of-the-art control technology.

In 1986, State evaluations for 9 additional source types were funded and evaluations at the State/local level were begun. In 1987, it is anticipated that as many as 20 additional evaluations will begin.

F. ASSESSING URBAN RISK

In 1986, EPA initiated planning and activities to encourage States to undertake new efforts toward assessing the scope and seriousness of current exposures to the mixtures of air toxic compounds which are believed commonplace in large metropolitan areas. A program has been developed which provides funds under section 105 of the Clean Air Act and technical assistance to States to encourage them to undertake such assessment efforts in at least 30 targeted areas with populations over one million people. Although the program does not mandate a particular assessment approach, it is expected that States' efforts will result in ambient monitoring, source/emission inventory analyses, and risk assessment activities to define whether the perceived problems indeed exist and, if so, how serious they are. A substantial effort in 1986 was the communication of needs to State and local agencies and other similar outreach activities.

In addition, activity on several Integrated Environmental Management Projects (IEMP) was continued. These projects, though multimedia in nature, focus a major portion of study on the air toxics aspects of the urban environment. In 1986, efforts were completed for the Philadelphia, Pennsylvania, and Santa Clara, California, areas as a result of work in previous years. In the Kanawha Valley, West Virginia, and Baltimore, Maryland, initial studies were concluded. Additional major monitoring efforts will be conducted in Baltimore in 1987. A new IEMP study was also initiated in Denver, Colorado.

The EPA also distributed guidance in 1986 on procedures for estimating emissions for selected potentially toxic pollutants. Final reports were distributed for ethylene oxide[7] and chlorobenzenes.[8] Reports are now in preparation for polycyclic organics, polychlorinated biphenyls, and benzene. Issuance of these additional documents is scheduled for 1987, pending the completion of peer review for each document. New work is also planned on improving emission factors for various area sources of toxic air pollutants.

G. BUILDING STATE AND LOCAL AIR TOXICS CONTROL PROGRAMS

The EPA has established a goal to have quality programs in every State and major local agency which are adequate to carry out certain roles envisioned for them within the national air toxics strategy. These roles are: (1) accepting delegation and enforcing national emission standards for hazardous air pollutants (NESHAP), (2) identifying, evaluating, and mitigating (as necessary) point sources of local concern not addressed by NESHAP, (3) addressing urban problems arising from complex multisource, multipollutant interactions, and (4) enhancing program capabilities to conduct applicable activities in the first three areas and to facilitate implementation of other programs specific to the needs of each State or community. During 1986, considerable progress was made toward meeting this goal. The progress was in part due to the establishment of a new program to enhance State and local program development. This program uses available grant funds to promote multiyear planning on the part of State and local agencies for building their air toxics capabilities and programs. Within a multiyear development plan, State and local agencies were encouraged to conduct the above-mentioned activities. In response, EPA received 63 multiyear development plans from 48 States and 15 local agencies. The major emphasis of the current State and local activities within these plans is now on development of toxics emissions inventories and modifying existing new source review permit systems to incorporate consideration of air toxic concerns. The amount of emphasis on additional technical skill development to handle risk assessment and toxic consideration varies greatly among the agencies and is usually proportional to the size of the agency and their perceived toxics problem.

In order to help the current and future implementation of scheduled multiyear development plan activities, EPA expanded its program of technical support in 1986. The EPA developed several technical documents on topics relevant to air toxics including guidance on ambient monitoring, modeling, emission inventory development, control technology evaluation, and control program development. Trial operation of a control technology center was also begun which will offer States and locals a variety of case-by-case technical assistance in making their control decisions. Finally, a series of national workshops were designed to assist State and local agencies in the basic aspects of program development and implementation. These workshops will be given by EPA in conjunction with the State and Territorial Air Pollution Program Administrators (STAPPA) and the Association of Local Air Pollution Control Officials (ALAPCO) in 1987.

In 1986, the National Air Toxics Information Clearinghouse (NATICH) was significantly expanded through the implementation of a computerized data base. Established in 1983, the Clearinghouse provides a tangible method of improving communication among EPA and State and local agencies. The Clearinghouse is funded by EPA and is a cooperative effort among EPA, STAPPA, and ALAPCO. The goal of the Clearinghouse is to disseminate information about activities under way to solve toxic air pollutant problems and to reduce duplication of effort. Some of the kinds of information included in the Clearinghouse are: (1) regulatory program activities, including acceptable ambient limits and emergency response program development; (2) source permit information, such as types and quantities of pollutants permitted and required control technology; (3) source test and ambient monitoring methods in use; (4) emission inventory information; and (5) selected EPA risk analysis results. With the implementation of the NATICH data base, the Clearinghouse users (e.g., State, local air quality management agencies, EPA, industry, environmental groups, and the public) may now have direct access to the Clearinghouse information through interactive programs. In addition to direct computer access to the data base, hardcopy reports of the data base information are printed and distributed annually. Other publications on air toxics distributed in 1986 included four issues of the Clearinghouse newsletter, a bibliography of reports and Federal Register notices related to air toxics,[9] a listing of EPA and National Institute for Occupational Safety and Health ongoing research and regulatory development projects,[10] a report on methods for selecting and prioritizing toxic air pollutants of concern,[11] a report that details how the Clearinghouse can be used to address air toxics questions[12] and a set of reports summarizing data submitted by State and local agencies.[13] Plans for 1987 include continuation of the prior publications, publication of a special report on carcinogenic risk assessment procedures, plus implementation of a new set of computer programs to enable authorized State and local agencies to directly enter and edit their data in the Clearinghouse files.

H. REFERENCES

1. U.S. Environmental Protection Agency, "A Strategy to Reduce Risks to Public Health From Air Toxics," June 1985.

2. 51 FR 22854, June 23, 1986.

3. 51 FR 34135, September 25, 1986.

4. 51 FR 27956, August 4, 1986.

5. 51 FR 34904, September 30, 1986.

6. 51 FR 34056, September 24, 1986.

7. Locating and Estimating Emissions from Sources of Ethylene Oxide, EPA 450/4-84-007l, September 1986.

8. Locating and Estimating Emissions from Sources of Chlorobenzenes, EPA 450/4-84-007m, September 1986.

9. Bibliography of Selected Reports and Federal Register Notices Related to Air toxics, EPA-450/5-86-008, July 1986.

10. Ongoing Research and Development Projects, EPA-450/5-86-007, June 1986.

11. Methods for Pollutant Selection and Prioritization, EPA-450/5-86-010, July 1986.

12. NATICH: How The Clearinghouse Can Help To Answer Your Air Toxics Questions, EPA-450/5-86-009, July 1986.

13. NATICH Data Base Report on State and Local Agency Air Toxics Activities, 1986, Vol. I, EPA-450/5-86-011a; Vol. II, EPA-450/5-86-011b, July 1986.

TABLE V-1

TOXIC AIR POLLUTANT EVALUATION AND CONTROL PROGRAM[1]

Preliminary Health & Source Screening	Detailed Assessment	Intent-to-List §112	Decision not to Regulate	Listed Under §112	NESHAP Proposed	NESHAP Promulgated
Propylene	Chlorine & HCl	Chromium	Toluene	Asbestos	Benzene	Mercury
Propylene oxide	Phosgene	Carbon tetrachloride	POM	Beryllium		Beryllium
Ammonia	Acetaldehyde	Ethylene oxide	CFC-113	Vinyl chloride		Asbestos
Zinc & Zinc oxide	Acrolein	Chloroform	Methyl chloroform	Coke oven emissions		Vinyl chloride
Styrene	Hydrogen sulfide	Ethylene dichloride	Epichlorohydrin	Benzene		Benzene
Naphthalene	Beryllium[2]	Cadmium	Manganese	Arsenic		Radionuclides
Toluene diisocyanate	Dibenzofurans	1-3-Butadiene	Chlorobenzenes	Radionuclides		Arsenic
Xylenes	Gasoline vapors	Methylene chloride	Vinylidene chloride	Mercury		
Ethyl chloride	Asbestos[2]	Perchloroethylene	Hexachlorocyclopentadiene			
Methyl methacrylate	Dioxins	Trichloroethylene	Chloroprene			
Maleic anhydride	Formaldehyde		Acrylonitrile[3]			
Phthalic anhydride	Municipal Waste Combustor Emissions		Nickel			
Methyl isocyanate			Phenol			
Mineral fibers						
Hydrogen fluoride						
Phosphorus						
Sodium hydroxide						
Hydrocyanic acid						
Selenium & compounds						
Mercuric chloride						
Bromine & inorganic compounds						
Dimethylamine						
Methanol						
Copper						

[1] As of December 31, 1986.
[2] Reassessment of original health effects information.
[3] Referred to States for evaluation.

VI. STATUS OF AIR QUALITY MANAGEMENT PROGRAMS

A. DEVELOPMENT OF POLICY AND REGULATIONS

Emissions Trading

The EPA published its final Emissions Trading Policy Statement (the "bubble policy") in December 1986.[1] The policy sets forth detailed criteria under which companies may substitute or "trade" extra emission reductions from sources less costly to control for emissions from sources that have higher control costs. The final policy authorizes the use of environmentally sound bubbles (emission trades between existing sources) in all areas of the country, as an important component of the nation's effort to achieve and maintain air quality standards.

The EPA issued the first emissions trading document in 1979, to address the issue of achieving air quality standards, maintaining economic growth, and to establish an incentive for innovative pollution control programs. A 1982 Interim Policy enlarged that early effort, integrated the bubble with other incentive-based approaches, and streamlined bubble approval processes. As a result, the EPA had, by the end of 1986, approved or proposed for approval over 50 bubbles as individual State implementation plan (SIP) revisions. In total, over 250 existing source bubbles were approved, proposed, or under development in 29 States.

The final Emissions Trading Policy Statement establishes a framework that will guide development of future bubbles. The policy addresses and clarifies previously issued guidance on emissions trading. In order to ensure the environmental integrity of future emissions trades, the policy also significantly tightens requirements applicable to certain trading actions, particularly existing source bubbles in primary nonattainment areas which require but lack demonstrations of attainment.

Implementation Policy and Guidance for Revised Particulate Matter Standards

As discussed in Chapter IV of this report, EPA proposed revised health-based (primary) national ambient air quality standards for particulate matter in 1984 that would apply to a size range of particles nominally 10 micrometers and smaller in diameter (PM_{10}), and an annual total suspended particulate (TSP) secondary (welfare-based) standard. The focus of the proposed primary standards on a new particle size range has necessitated preparation of regulations, policy, and technical guidance so that SIP's for PM_{10} can be developed.

On April 2, 1985, EPA published a Federal Register notice which solicited public comments on (1) regulatory amendments which would accommodate the focus of the primary standards on the PM_{10} size range and which would integrate PM_{10} requirements into new source review programs, (2) a policy for SIP development for primary and secondary standards and the EPA's interpretation of the Clean Air Act which results in that policy, and (3) technical guidance specific to dealing with the PM_{10} size range.[2] The proposed regulatory amendments would focus the health-protecting air pollution episode programs on PM_{10} rather than TSP and would describe the requirements for a dual new source review system, i.e., new sources would be reviewed for both PM_{10} and TSP emissions. The SIP development policy would establish timeframes for SIP development for the primary and secondary standards. The PM_{10} technical guidance addresses development of emission inventories, dispersion and receptor modeling, ambient monitoring and data reporting, using ambient TSP data where PM_{10} data are not available, and monitoring for prevention of significant deterioration purposes.

Seventy-two comment letters were received, mostly from industry. The issue most frequently commented upon was the legal interpretation of the Clean Air Act as it would apply to primary PM_{10} standards. Other items addressed frequently were the need for ambient PM_{10} data before SIP development, the fugitive dust policy, the construction ban, continuation of stringent nonattainment area offset requirements for particulate matter, and the need for two different sets of prevention of significant deterioration (PSD) increments for particulate matter (i.e., TSP and PM_{10} increments).

Public comments have been summarized and issues identified for resolution. At the end of 1986, EPA was in the process of resolving the issues raised and developing regulations to implement the revised standards.

Ozone Nonattainment Policy

In 1985, EPA began reviewing the problem of continuing nonattainment of the ozone air quality standard in almost all urban areas despite past efforts by States and EPA to reduce precursor emissions. The Clean Air Act deadline for attaining the ozone standard is the end of 1987; however, about 60 metropolitan areas were projected to not likely attain the standard by then. In 1986, EPA continued to analyze the post-1987 nonattainment problem and to identify and evaluate alternative approaches to solving the problem. A number of regulatory areas were examined in early 1986 for potential emission reductions which could result from improvements to the existing program and from new control initiatives. During 1986 EPA examined a number of possible control measures in detail and discussed the features of a national ozone policy with State and local air agencies, environmental and industrial organizations, and Congressional staff.

The EPA also continued to examine the overall options for responding to the nonattainment problem in light of the Clean Air Act's lack of specific direction in this area. Although the Clean Air Act did not address post-1987 nonattainment directly, EPA wanted to follow a course that had as solid a legal foundation as possible, while at the same time continuing an effective dialogue with Congress that could result in legislative actions if needed. To fully understand the range of optional approaches that EPA might choose or be required to follow, EPA began investigation in late 1986 of an option under which EPA would disapprove inadequate SIP's and develop and implement Federal implementation plans (FIP's). The EPA expects to use the results of the FIP analysis, the examination of alternative control measures, and the continuing dialogue with State and local air agencies and officials, environmental and industrial organizations, and Congressional committees and staff in the development of a national ozone policy. This policy will be proposed in 1987.

Visibility Protection

Section 169A of the Clean Air Act establishes as a national goal "the prevention of any future, and the remedying of any existing, impairment of visibility in mandatory Class I Federal areas which impairment results from manmade air pollution." On December 2, 1980, EPA promulgated regulations implementing this section.[3] All States which contained mandatory Class I Federal areas were to develop and submit SIP revisions to EPA which implemented these regulations.

On December 20, 1982, a number of plaintiffs filed suit in the United States District Court for the Northern District of California seeking to compel EPA to promulgate State plans for visibility protection under section 110(c) of the Clean Air Act for those States which had not submitted such plans. During 1983, EPA and the plaintiffs negotiated and signed a settlement agreement which was accepted by the court on April 20, 1984. The settlement agreement calls for a two-part implementation of the 1980 rules. New source review requirements and a visibility monitoring strategy were proposed for the 34 deficient States in October 1986. In a series of actions started on July 12, 1985, and finishing in 1986, EPA promulgated FIP's or approved State-submitted implementation plans to deal with visibility monitoring and new source review.

On September 9, 1986, the Court approved a revision to the settlement agreement. Under that revised agreement, EPA can delay proposing portions of the implementation plans dealing with existing impairment until August 1988. However, the remaining portions of the plans must be proposed by February 1987.

Tall Stacks and Other Dispersion Techniques

In July 1985, EPA adopted revisions to regulations originally promulgated in 1982 which prohibit reliance by stationary sources on stack heights in excess of "good engineering practice" or on any other dispersion techniques in lieu of emission controls.[4] In accordance with the Clean Air Act, States were given 9 months to review their rules and source emission limitations and to revise their SIP's and resubmit them to EPA as necessary. During 1986, EPA received SIP revisions from the States in response to the stack height regulations. These revisions were being processed by EPA at the end of 1986.

Several interested parties filed for judicial review of the revised stack height regulations and, in addition, several of those parties also filed petitions for reconsideration of those regulations. Some of the petitions which dealt with a specific source were denied in April 1986.[5] Since the other petitions dealt with the basic legal foundations for the regulations, EPA is deferring responding to them until judicial review of the revised regulations is completed.

Federal Enforcement of Visible Emissions

In August 1986, EPA proposed a new, modified visible emission test method for evaluating compliance with certain types of SIP opacity standards where the State has not specified a test method in the SIP.[6] The existing method for Federal enforcement of SIP opacity limits in such cases is Test Method Number 9 of 40 CFR 60. If adopted, this revised procedure would provide EPA with an expanded array of specific visible emissions testing procedures for various types of SIP opacity emission limitations and would allow EPA to better enforce SIP provisions. At the end of 1986, EPA was reviewing the comments submitted in response to the proposal.

Restructuring SIP Preparation Regulations

In November 1986, EPA published final changes to the SIP preparation regulations of 40 CFR 51.[7] The rulemaking deleted obsolete provisions and rewrote the regulations in a new, shorter, and better-organized format. States using the revised regulations to prepare SIP's will find them more current and easier to follow than the old regulations. The new format also has a flexible structure into which future requirements can be more easily incorporated.

B. PREVENTION OF SIGNIFICANT DETERIORATION AND NONATTAINMENT NEW SOURCE REVIEW ACTIVITIES

The EPA made significant progress in 1986 in carrying out its responsibilities under the Clean Air Act regarding the preconstruction review of new and modified stationary sources. Major 1986 activities are described below.

PSD Program Transfer

The EPA continues to emphasize the importance of high quality transfers of PSD and new source review programs. In addition to the strong legal and resource reasons for implementation by State and local authorities rather than EPA, the EPA believes that the critical growth decisions associated with the preconstruction review process should be made at the State and local level. The permitting process, once transferred, forms the key for minimizing source-specific SIP revisions in the future. In 1986, EPA continued its progress in transferring implementation of the PSD program to State and local agencies. The majority of PSD permits are now issued by these agencies. Although several transfers are presently being held up by litigation and resulting policy clarification, progress was made nevertheless. As of the end of 1986, 44 State and local agencies had either full delegation of the PSD program or a PSD SIP, and 8 more had partial responsibility for the PSD program.

Chemical Manufacturers Association v. EPA

As previously reported, the EPA's PSD and nonattainment new source review regulations have been challenged by a variety of entities. These challenges were consolidated as Chemical Manufacturers Association v. EPA (CMA), D.C. Cir. No. 79-1112. On February 22, 1982, EPA entered into a litigation settlement with the industry petitioners in which it agreed to propose certain regulatory changes. An important part of the settlement agreement was satisfied by EPA's *Federal Register* proposal of August 1983.[8] That proposal addressed the topics of fugitive emissions in new source review applicability determinations, Federal enforceability of various emissions reductions, "buffer zones" around Class I areas, review of secondary emissions, and offset credit for past source shutdowns. At the end of 1985, EPA had prepared final action on a significant portion of the settlement. These documents underwent internal EPA review during 1986. Publication is planned for 1987.

An important related matter of controversy has been the definition of "source" for the purposes of nonattainment new source review. The Clean Air Act is not clear in this area. In 1980, EPA promulgated a dual source definition that minimized the opportunity for modifications to sources to avoid review in nonattainment areas.[9] This was challenged by industry in the CMA suit, but was not of primary concern in the settlement because EPA had replaced it with a "plantwide" definition in its rulemaking of October 14, 1981.[10] The Natural Resources Defense Council (NRDC) claimed that the plantwide definition is inconsistent with the Clean Air Act and, on August 17, 1982, the D.C. Circuit Court of Appeals ruled in their favor. Both EPA and industry representatives appealed this ruling, and on June 25, 1984, the Supreme Court decided in favor of EPA and the industry litigants. The EPA is presently developing a policy which will aid the Regions in processing proposed SIP's converting to a plantwide definition. Resolution of the definition of source should significantly accelerate the processing of revisions to the nonattainment portions of SIP's.

In an August 7, 1980, promulgation, EPA listed 30 source categories for which fugitive emissions would be included in PSD applicability determinations.[9] Surface mining operations were not among these. The Sierra Club sued EPA on this point and on August 26, 1983, the D.C.

Circuit Court of Appeals remanded this matter to the EPA for explanation of its position. In October 1984, EPA published final action on this issue, reaffirming its current requirements for the inclusion of fugitive emissions in calculating whether a source is "major" for purposes of new source review.[11] The EPA further proposed to extend the requirements for inclusion of fugitive emissions to surface coal mining operations.[12] According to the rulemaking criteria established by EPA, the proposed listing of surface coal mines is only a presumption which can be overcome if the rulemaking record reveals that the costs associated with listing are unreasonable relative to the corresponding benefits. A regulatory impact analysis has been prepared on that proposal and was made available for public comment in early 1986. Resolution of this issue is expected in 1987.

C. IMPLEMENTATION OVERVIEW AND ASSISTANCE

National Air Audit System

The National Air Audit System (NAAS) was developed in 1983 as a joint effort by EPA, the State and Territorial Air Pollution Program Administrators (STAPPA), and the Association of Local Air Pollution Control Officials (ALAPCO). The primary goals of the NAAS are to identify any obstacles that are preventing State and local air pollution control agencies from implementing effective air quality management programs and to provide EPA with quantitative information for use in defining more effective and meaningful national programs. The five air quality management areas of motor vehicle inspection maintenance, air quality planning and SIP activities, new source review, compliance assurance, and air monitoring are included in the NAAS. The NAAS started operating on a 2-year cycle in 1986 and all State agencies will be audited in the 1986-1987 cycle. A national report covering the results of these audits will be prepared at the end of 1987. EPA-specific deficiencies identified in the audits are being corrected through agreements between the EPA Regional Offices and the audited agencies.

State Implementation Plans for Lead

In July 1982, the NRDC filed suit to require EPA to approve, or disapprove and promulgate, lead SIP's for States that did not submit adequate SIP's. The EPA negotiated a settlement with the NRDC giving States and EPA additional time for completing the SIP's. During the time provided for in the settlement agreement, the EPA and the States completed rulemaking for 29 of the 36 outstanding lead plans. Twenty rulemakings were completed prior to the NRDC suit. On August 30, 1986, the NRDC filed a motion with the D.C. District Court to force the EPA to a revised schedule for completion of actions on lead SIP's for four States. At the end of 1986, EPA was working with the NRDC and the Court to establish a revised schedule for completing rulemaking on all seven remaining plans. A new schedule was provided to the court in 1987.

During 1986, the EPA approved three lead SIP's: Alabama (except for Jefferson County),[13] Northern Marianas Islands (except for new source review),[14] and New Jersey (except for three sources).[15] In addition, EPA proposed approval of the lead SIP for Jefferson County, Alabama.[16]

Acid Deposition Implementation Issues

In 1984, EPA initiated an effort to explore with the States the potential issues that could arise in implementing possible acid deposition control programs that might be required. Accomplishment of this effort was planned in three phases--identifying key implementation issues and major options for dealing with them, evaluating various options using both "in-the-field" and "in-house" approaches, and preparing preliminary or prototype guidance on the issues. Major progress was made in 1984 on the first phase as EPA, in coordination with State and local air agencies, produced an initial listing and description of over 200 implementation issues.

In 1985, the focus shifted to analyzing the issues and evaluating the options for dealing with them, particularly through "in-the-field" studies. These studies, called State Acid Rain (STAR) projects, were to be conducted by individual States although the results could have broad applicability to other States that might be involved in a possible acid rain control program. The projects were eligible for $3 million in section 105 funds that Congress had appropriated for this effort.

In application for this funding, State and local agencies submitted 53 proposals, and EPA, after consulting with STAPPA/ALAPCO, selected 31 projects for an initial round of funding. The EPA later reviewed the range of issues covered by the projects and identified six additional STAR projects for funding. In all, the section 105 special appropriation was able to fund 37 of the 59 project proposals. The projects were generally scheduled to be completed within a 1- to 2-year time period. Thirty-seven States were involved in the effort directly and special procedures were established to allow other States to participate in the review and evaluation of the projects. A national STAR workshop was held in November 1985 for EPA and the States to discuss and review the progress of the STAR projects thus far.

In 1986, work on the STAR projects continued, and EPA began reviewing and synthesizing available results from the projects. The EPA has also been able to use the preliminary findings and experiences of the STAR projects in evaluating proposed acid rain control legislation, particularly in regard to implementation schedules and requirements. A second national STAR workshop, held in October 1986, provided States the opportunity to present their initial findings and discuss implementation requirements of hypothetical acid rain legislation.

Volatile Organic Compound RACT Clearinghouse

In conformance with the Clean Air Act, sources of volatile organic compounds (VOC's) for which a control technique guideline (CTG) has been issued by EPA (as well as non-CTG sources with a potential to emit 100 tons of VOC per year or greater) are required to install reasonably available control technology (RACT). This requirement is applicable in areas that have requested an extension until December 31, 1987, to demonstrate attainment of the ozone standard and in areas for which EPA requires a SIP revision for failure to attain the ozone standard by December 31, 1982. RACT for these sources must be determined on a case-by-case basis. RACT is the lowest emission limit that a particular source is capable of meeting by the application of control technology that is reasonably available considering technological and economic feasibility.

The purpose of the VOC RACT Clearinghouse is to provide a means by which State and local air pollution control agencies can exchange technical information, minimize duplication of effort and resources, and provide guidance regarding VOC controls for various industrial operations and other sources. The VOC RACT Clearinghouse is a cooperative effort with STAPPA/ALAPCO and EPA.

The VOC RACT Clearinghouse output takes several forms, including a VOC RACT Clearinghouse Newsletter. During 1986, three newsletters were issued. Other outputs included a VOC RACT Clearinghouse Newsletter subject index and an update to the index of article titles.

Status of Nonattainment Areas

The following table lists by pollutant those areas of the country that were designated as nonattainment for the national ambient air quality standards as of the end of 1986. Note that totals are not shown since the same area may be nonattainment for more than one pollutant. A significant portion of the carbon monoxide and ozone nonattainment areas shown below are areas which received an attainment date extension under the Clean Air Act to December 31, 1987.

Pollutant	Number of Nonattainment Areas*
Carbon Monoxide	152
Nitrogen Dioxide	4
Ozone	358
Sulfur Dioxide	58
Total Suspended Particulates	284

* Areas listed are either counties or portions of counties.

D. AIR POLLUTION TRAINING

In 1986, EPA continued to provide technical training in the abatement and control of air pollution. This training included short course presentations (3 to 5 days in length), self-study courses, technical assistance to others who conduct training, and the support of traineeships and fellowships for graduate air pollution training.

During 1986, EPA conducted 30 short courses in 20 different subject areas for a total of 852 students. These courses were presented in locations across the U.S. by seven universities designated as area training centers. Technical assistance was provided to States and EPA Regional Offices for conducting 27 additional courses reaching a total of 656 students.

In support of the delegation of more air quality management responsibilities to the States, EPA continued emphasis on self-study courses as a means of providing training to more air pollution personnel. During 1986, 1128 students applied for the 30 self-study courses presently available.

As an additional means of developing qualified personnel, EPA supported 17 graduate traineeships/fellowships to employees of State and local air pollution control agencies. These awards are for both part-time and full-time graduate study in the field of air pollution control.

E. REFERENCES

1. 51 FR 43814, December 4, 1986
2. 50 FR 13130, April 2, 1985
3. 45 FR 80084, December 2, 1980
4. 50 FR 27892, July 8, 1985
5. 51 FR 15885, April 29, 1986
6. 51 FR 31076, August 29, 1986
7. 51 FR 40656, November 7, 1986
8. 48 FR 38742, August 25, 1983
9. 45 FR 52676, August 7, 1980
10. 46 FR 50766, October 14, 1981
11. 49 FR 43202, October 26, 1984
12. 49 FR 43211, October 26, 1984
13. 51 FR 25366, July 14, 1986
14. 51 FR 40798, November 10, 1986
15. 51 FR 42565, November 25, 1986
16. 51 FR 25715, July 16, 1986

VII. CONTROL OF STATIONARY SOURCE EMISSIONS

A. NEW SOURCE PERFORMANCE STANDARDS (NSPS)

Section 111 of the Clean Air Act provides authority for EPA to regulate new stationary sources of air pollution from source categories which cause, or contribute significantly to, air pollution which may reasonably be anticipated to endanger public health or welfare. During 1986, NSPS were promulgated under this section for emissions of particulate matter and nitrogen oxides from the industrial boiler source category.[1] The existing NSPS for basic oxygen process furnaces, asphalt concrete plants, and kraft pulp mills were revised.[2,3,4] Standards were proposed for calciners and dryers, plastic business machines, magnetic tape, and for sulfur dioxide emissions from industrial boilers.[5,6,7,8] A revision to the existing NSPS was proposed for sewage sludge incineration.[9]

B. BEST AVAILABLE CONTROL TECHNOLOGY/LOWEST ACHIEVABLE EMISSION RATE (BACT/LAER) CLEARINGHOUSE

New or modified facilities that are to be constructed in areas of the country that are currently attaining the national ambient air quality standards are required by the Clean Air Act to install BACT. In those areas of the country that have not yet achieved compliance with the air quality standards, new or modified facilities are required to meet the LAER for that particular type of source. Both BACT and LAER requirements are determined on a case-by-case basis. Often an air pollution control agency will need to establish BACT or LAER requirements for a source type that is completely new to them or for which they have had only minimal experience. In these cases, the permitting agency may not be knowledgeable of the more recent advances in control technology for such sources and it is extremely helpful if the agency can refer to BACT or LAER determinations made by other control agencies.

The EPA established the BACT/LAER Clearinghouse several years ago in order to assist State and local air pollution control agencies by promoting the sharing of air pollution control technology information. The primary output of the Clearinghouse is an annual report of information about BACT/LAER determinations made by the various control agencies. The report published in 1986 contains over 1120 BACT/LAER determinations.[10] The report is available in hard copy or through an automated system. The automated data base can be accessed by both the public and private sectors.

C. REFERENCES

1. 51 FR 42768, November 25, 1986.

2. 51 FR 150, January 2, 1986.

3. 51 FR 3298, January 24, 1986.

4. 51 FR 18538, May 20, 1986.

5. 51 FR 15438, April 23, 1986.

6. 51 FR 854, January 8, 1986.

7. 51 FR 2996, January 22, 1986.

8. 51 FR 22384, June 19, 1986.

9. 51 FR 13424, April 18, 1986.

10. "BACT/LAER Clearinghouse - A Compilation of Control Technology Determinations, First Supplement to 1985 Edition." May 1986.

VIII. STATIONARY SOURCE COMPLIANCE

A. GENERAL

The goal of the Clean Air Act is to protect public health and welfare and to enhance the quality of the nation's air. The stationary source compliance program is designed to assure compliance with air emission standards by stationary sources of air pollution, including such major facilities as power plants, steel mills, smelters, and refineries. In addition to ensuring compliance with emission limitations contained in State implementation plans (SIPs), EPA and delegated States are responsible for ensuring that sources comply with new source performance standards (NSPS) and national emission standards for hazardous air pollutants (NESHAP).

The EPA closely monitors the compliance status of about 32,000 stationary sources of air pollution. Approximately 28,000 of these sources are Class A SIP sources,* about 3,000 are NSPS sources, and about 1,000 are NESHAP sources. At the end of 1986, as has been the case since the late 1970's, the compliance rates were high as shown in the table below:

Compliance Status of Federally Tracked Stationary Sources

Source Type	In Compliance	In Violation, Meeting Schedule	In Violation, No Schedule	Status Unknown
Class A SIP	92.5%	2.1%	4.1%	1.2%
NSPS	91.0%	1.9%	4.9%	2.2%
NESHAP	86.9%	3.2%	6.2%	3.2%

The compliance status of stationary sources is determined and tracked principally by the States. The States (and EPA) have the authority to enter and inspect stationary sources in order to obtain information for determining compliance status or preparing possible enforcement actions or for other purposes. In 1986, the States conducted 28,463 inspections and source tests of Class A SIP, NSPS, and NESHAP sources.

The EPA overviews the States' compliance monitoring activities and supplements their enforcement efforts to resolve violations of air quality regulations. In 1986, EPA conducted 2,353 inspections and source tests of Class A SIP, NSPS, and NESHAP sources.

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*A Class A SIP source is a stationary source which, while operating at design capacity, has actual or potential uncontrolled emissions equal to or greater than 100 tons per year of any regulated air pollutant.

The Clean Air Act provides a variety of administrative enforcement mechanisms for dealing with both special situations and relatively easily corrected violations. During 1986, EPA issued immediate compliance orders under section 113(a) of the Clean Air Act to 117 sources and issued or approved delayed compliance orders under section 113(d) for 11 sources.

Section 120 of the Clean Air Act is an administrative remedy designed to recoup the economic benefit which may come from violating air pollution control regulations. Eleven section 120 cases were initiated in 1986.

The EPA is also authorized to file civil and criminal actions in Federal District Court to compel a source to comply with applicable requirements, to pay penalties, or both. There were 71 Federal civil actions filed in 1986 against stationary sources for violations of the Clean Air Act. As of January 1987, a total of 122 such actions were pending with the U.S. District Courts. During 1986, two corporations were convicted of criminal violations of the Clean Air Act. In one case a $24,000 criminal fine was imposed for violations of the asbestos handling requirements. The other case represented the first conviction for violations of a SIP, and resulted in a $10,000 fine against a corporation operating a refuse incinerator without a certification. In addition, two cases of alleged illegal asbestos handling operations were referred to the Department of Justice for criminal prosecution during 1986.

A major focus of the stationary source compliance program is the effort to return to compliance those sources considered to be "significant violators." The universe of sources covered by this program includes those that are in violation of NESHAP or NSPS regulations, and non-compliant Class A SIP sources which contribute significantly to non-attainment. For FY 1986 (the period starting October 1, 1985 and ending September 30, 1986), EPA identified 647 significant violators pending at the beginning of the fiscal year. By the end of the fiscal year, 511 had been addressed. Of these, 244 were returned to compliance, 121 were placed on an acceptable compliance schedule, and 146 had an enforcement action pending. In addition, 489 significant violators were newly-identified during FY 1986 and, of these, 144 were addressed by the end of the fiscal year.

In 1984, EPA issued guidance on the "timely and appropriate" EPA/State enforcement response for significant air violators. On April 11, 1986, this guidance was reissued to include NESHAP violators. The guidance provides timelines for action, addresses EPA issuance of notices of violation (particularly when the primary agency does not take action), and discusses when penalties must be obtained. In 1986, for the second consecutive year, EPA evaluated the implementation of the "timely and appropriate" guidance. The evaluation showed that all Regions have systems in place to monitor the timeliness of enforcement actions after findings of noncompliance. Also, Regions are doing a better job in issuing Federal notices of violation within timeframes set by the guidance; improvement in this area is still expected, however.

The "timely and appropriate" guidance also requires assessment of penalties under certain circumstances. Evaluation revealed that in 1986 penalties were generally collected by the States and EPA where the guidance requires. Finally, all EPA Regional Offices continued to feel that the guidance has had a positive effect on the compliance and enforcement programs. Both States and Regions want the guidance to remain basically unchanged for the near future.

An area of intensive effort for the last 3 years is the regulation of sources of volatile organic compounds. These sources are major contributors to the ozone nonattainment problem and some emit compounds which are highly toxic in nature. In response to requirements contained in the 1977 Clean Air Act Amendments, many States adopted regulations requiring compliance of such sources on or before the end of 1982. Carrying out these regulations has led to a large growth in the number of significant violators.

In 1986, the stationary source compliance program continued its major initiative to ensure that demolition and renovation sites are in compliance with asbestos NESHAP regulations. The demolition and renovation of old buildings, often in highly populated urban areas, can be a major source of asbestos exposure. Because of the large number of demolition sites, a strong State and EPA effort is necessary to the success of the program. The program addresses training, inspection techniques, compliance tracking, enforcement mechanisms, and other aspects essential for ensuring compliance.

During 1986, EPA and the States received 26,993 asbestos demolition or renovation notifications, conducted 15,060 asbestos inspections, and found 2,179 violations. The EPA issued 454 notices of violation or deficiency, issued 59 administrative actions, and initiated 33 civil actions for violations of asbestos demolition and renovation regulations. Delegated States also conducted a high level of asbestos enforcement actions during 1986. The States issued 535 notices of violation or deficiency, issued 124 administrative orders, and initiated 26 civil actions.

On July 11, 1984, EPA issued a vinyl chloride NESHAP enforcement strategy which facilitates the development of civil complaints against violators of vinyl chloride regulations. The EPA filed one new civil action during 1986 for violations of the vinyl chloride standards. At the end of 1986, 14 enforcement actions for violation of these standards were in litigation.

In the decade of the 1970's, the stationary source compliance program focused on ensuring that major sources of particulates and sulfur dioxide achieved initial compliance with the Clean Air Act regulations, generally by either installing required control equipment or by switching to cleaner fuels. The more recent focus of attention is concerned with the continuous compliance of particulate and sulfur dioxide sources (while continuing work to ensure initial compliance for sources of volatile organic compounds). The current continuous compliance strategy, initiated in 1984, builds upon use of on-site inspections as a major compliance monitoring method. It outlines a number of areas, such as unannounced inspections, better targeting of sources, and improved inspection techniques to produce inspections more useful for determining the compliance status of sources during day-to-day operation. The strategy also calls for an increased use of continuous emission monitoring system (CEMS) data, supported by an EPA initiative to enhance CEMS usage. During FY 1986 and FY 1987, in support of this strategy, EPA has required agency tracking and reporting of CEMS usage for NSPS sources required to install CEMS. Also in 1986, EPA issued guidance on using CEMS data to assess compliance, target inspections, and support enforcement.

The EPA has been conducting pilot programs to improve implementation of the continuous compliance strategy. A 2-year (1984-1985) pilot in Virginia on methods to improve the effectiveness and efficiency of the inspection process found that specialized training can improve inspection quality and save resources, different levels of inspection are appropriate if combined with a targeting strategy, and inspection results should be used as part of the inspection planning process. Another pilot, conducted primarily in Missouri, evaluated the effectiveness of a CEMS program as a component of a multifaceted compliance monitoring effort and found it to be a useful tool for targeting inspections. Finally, in 1986, EPA continued pilot programs in Michigan and Colorado to develop more sophisticated methods for targeting compliance monitoring inspections.

B. LITIGATION

The following are examples of significant enforcement actions which were concluded in 1986.

1. Significant Judicial Decisions

Dow Chemical Co. v. United States, 106 S. Ct. 1819 (1986)

In this case, the Supreme Court construed the Clean Air Act as conferring broad inspection powers on EPA. All nine Justices agreed that EPA could hire a commercial photographer to fly over a plant owned by the Dow Chemical Company and take pictures. They ruled that regulatory authority generally carries with it the ability to employ all useful modes of investigation. Even though the statutory section dealing with inspections did not mention aerial photography, the Court found that EPA needed no explicit authorization to use methods of observation commonly available to the public at large. On fourth amendment issues, the Court divided five to four with the majority holding that the overflights did not require a warrant. The majority believed that trade secrets law was irrelevant to defining the scope of fourth amendment protection. Despite the dissenters' concerns about commercial privacy interests, the majority relied on the lack of physical entry to uphold the search.

United States v. Geppert Bros., Inc., 638 F. Supp. 996 (1986)

Regulations controlling the release of asbestos from demolition activities apply to the "owner or operator" of a demolition or renovation operation. In this case, the court held that the building owner is liable for violations, along with the contractor who actually did the demolition work. Relying on a published response to comments during the rulemaking as well as the text of the regulation, the court concluded that the building owner is the owner of the "source" from which pollution is emitted. Moreover, the court found that a demolition contract with salvage rights did not transfer ownership of the building to the contractor. The court noted that imposing the obligation on both parties was important to further the regulatory purpose of insuring that buildings are demolished in a way that minimizes release of asbestos dust.

2. Significant Administrative Decision

In the Matter of International Harvester Company,
Docket No. CAA-120-V84-1

On December 19, 1986, the presiding Administrative Law Judge (ALJ) ruled in favor of EPA with respect to liability in this action, brought under section 120 of the Clean Air Act. The EPA's Notice of Noncompliance alleged that International Harvester exceeded Ohio SIP limitations governing volatile organic compound emissions at its Springfield truck assembly plant. In his decision, the judge rejected the company's allegations that service of the notice was defective, that the pertinent SIP provision does not regulate paint booths lacking bake ovens, that certain of its painting operations were exempt from regulation under the SIP provision's "refinishing" exemption, and that the provision in issue does not regulate the company's nonmetallic painting operations.

3. Significant Settlements

United States v. Jefferson Smurfit Corporation, et al.,
Civil No. C-184-1617 (S.D. Ohio)

On March 25, 1986, a consent decree was entered resolving this action, which alleged violations by the defendant of Ohio SIP provisions regulating volatile organic compound emissions. The basic terms of settlement were the defendant's agreements to bring its offending operations into compliance by March 31, 1987, by installation of pollution control equipment, and to pay a civil penalty of $120,000. The injunctive relief and civil penalty obtained are significant in the context of volatile organic compound enforcement actions against sources which assert--unreasonably, in EPA's view--that they can comply by use of reformulated coatings not yet developed. This decree is clear evidence that EPA can insist on installation of controls and that thé court may levy substantial fines when air pollution regulations are violated.

U.S. v. Phelps Dodge Corp., C.A. No. CIV 86-424 TUC WDB (D. Az.)

On October 20, 1986, the U.S. District Court for Arizona entered a consent decree resolving Clean Air Act violations at Phelps Dodge Corporation's Douglas Reduction Works copper smelter in Douglas, Arizona. The smelter achieved compliance with the Clean Air Act and the Arizona sulfur dioxide and particulate matter SIP limits by permanently ceasing smelting operations on January 15, 1987. In addition, Phelps Dodge was fined $400,000 in civil penalties, and was required to meet stringent interim emissions curtailment requirements. The State of Arizona and the Environmental Defense Fund joined the settlement as plaintiff-intervenors.

4. Enforcement Initiatives

Asbestos Multicase Initiative

On January 16, 1986, the Department of Justice, on behalf of EPA, filed eleven cases nationwide for violations of the asbestos NESHAP in the course of demolitions and renovations. The initiative was designed to heighten public awareness of the dangers of asbestos exposure due to demolitions and renovations, and EPA's regulations applicable to these activities. The initiative received considerable attention from the news media, including coverage on two network television and two network radio news shows. Four of these cases have been settled so far for civil penalties ranging from $10,000 to $32,000.

L.A. Basin VOC Initiative

On June 30, 1986, EPA filed eight civil cases under the Clean Air Act against metal parts manufacturing and coating facilities located in the Los Angeles area, to enforce California SIP emissions limits for volatile organic compounds. Six of the eight cases were settled in December 1986, with expeditious compliance schedules and civil penalties in the $17,000 to $50,000 range. The remaining two cases are expected to be settled in 1987.

C. COMPLIANCE AND ENFORCEMENT GUIDANCE

On June 11, 1986, EPA issued its final inspection frequency guidance for stationary sources of air pollution. For the past 2 years the guidance has been modified in response to both State and EPA Regional concerns about the need for added flexibility, national consistency and quality. The guidance also freezes any additional changes while it is being implemented.

Other important guidance issued in 1986 includes guidance on granting compliance date extensions for individual volatile organic compounds sources in ozone nonattainment areas (issued August 7, 1986), guidance on reasonable installation timeframes for sources proposing use of low-solvent technology as a means to comply with volatile organic compound emission regulations (also issued August 7, 1986), a revised "timely and appropriate" policy expanding the coverage to include NESHAP sources (issued April 11, 1986), guidance on what constitutes a Federal reportable violation (issued April 11, 1986), guidance to assist in the implementation and enforcement of the arsenic NESHAP for glass manufacturing (issued October 1, 1986), final enforcement guidance advocating increased use of continuous emission monitoring system data for direct Federal enforcement of stationary source air pollution requirements (issued April 22, 1986), two policies to provide guidance on enforcing regulations for controlling emissions of volatile organic compounds which are precursors to ozone (issued January 17, 1986), and a revised civil penalty policy for cases involving the vinyl chloride NESHAP (issued April 18, 1986).

D. COMPLIANCE BY FEDERAL FACILITIES

During 1986, Class A SIP, NSPS, and NESHAP Federal facilities demonstrated a good record of compliance with applicable air pollution regulations. As of the end of 1986, 313 (88 percent) of the 334 operating Federal facilities are in compliance, 12 are meeting schedules that will bring them into compliance, 25 are in violation and not yet on an acceptable schedule, and 4 are of unknown compliance status.

E. LIST OF VIOLATING FACILITIES

The List of Violating Facilities, established by section 306 of the Clean Air Act, is designed to prevent the Federal government from doing business with facilities which have violated selected sections of the Clean Air Act.

Four facilities were placed on this list in 1986:

° The B.F. Goodrich Company's Louisville, Kentucky, facility was placed on the list on February 10, 1986, for violations of 40 C.F.R. section 61.64(a)(2) (reactor opening losses) and section 61.64(e)(1)(ii) (emissions from sources following strippers).

° The Waterbury House Wrecking Company, in Waterbury, Connecticut, and the Old Pin Shop in Oakville, Connecticut, were both placed on the list as a result of their criminal convictions on December 19, 1985, for violations of section 113(c)(1) of the Clean Air Act (failure to properly remove asbestos prior to demolition of a building).

° Robert E. Derecktor of Rhode Island, Inc.'s Middletown, Rhode Island facility was placed on the list as a result of its criminal conviction on December 29, 1986, under section 113(c)(1) of the Clean Air Act for violations of NESHAP work practice standards while removing asbestos. (Note that Derecktor also was placed on the list for violations of section 309(c) of the Clean Water Act.)

Under the regulations issued to implement EPA's listing authority, a facility may correct the violation which caused it to be listed and petition EPA's Assistant Administrator for Enforcement and Compliance Monitoring to be removed from the List. On February 10, 1986, the Assistant Administrator determined that Sierra Transit Mix, Inc.'s Las Vegas, New Mexico facility had corrected the conditions which caused it to be listed and removed Sierra Transit from the list. Two of the above facilities currently on the list have submitted petitions requesting removal. The EPA is currently investigating the validity of each claim.

IX. CONTROL OF MOBILE SOURCE EMISSIONS

A. INTRODUCTION

Control of motor vehicle emissions has been a Federal responsibility since 1968. The requirements of the Clean Air Act relating to mobile sources have been subsequently refined several times, most recently in 1977. The Clean Air Act Amendments of 1977 established an ambitious regulatory program which addressed remaining problems in the motor vehicle emissions control program and bolstered efforts to attain and maintain the national ambient air quality standards for carbon monoxide and ozone. Below are listed some of the mobile source provisions of the 1977 Clean Air Act Amendments.

- A schedule was established for implementation of stringent emissions standards for automobiles -- 0.41 grams per mile (gpm) for hydrocarbons, 3.4 gpm for carbon monoxide and 1.0 gpm for oxides of nitrogen. The table below displays the level of control mandated by the standards.

New Light-Duty Vehicle Emissions

	Without Control	1977 CAA Standard	Percent Reduction
Hydrocarbons	8.8 gpm	.41 gpm	95%
Carbon Monoxide	87.0 gpm	3.40 gpm	96%
Oxides of Nitrogen	3.6 gpm	1.00 gpm	72%

- Similarly, the amendments tightened standards for emissions of the above-mentioned pollutants from heavy-duty engines.
- Standards for the control of particulate emissions from heavy-duty diesel engines were mandated.
- Areas not meeting carbon monoxide and ozone ambient air quality standards were required to implement motor vehicle inspection and maintenance (I/M) programs.

Since the enactment of the 1977 amendments, EPA has made steady progress toward achieving the Clean Air Act's goals. The EPA has made a number of modifications to its motor vehicle emissions standards in order to assure that they attain the goal of cleaner air as effectively and efficiently as possible. In 1986, EPA made significant progress in the implementation of this program.

B. OZONE CONTROL

With the increased focus on reducing ozone levels, EPA has continued work on several areas directly aimed at this goal. One of the key actions is controlling excess evaporative emissions through regulation of in-use gasoline volatility. The EPA held a hearing and workshop in 1986 on gasoline volatility. Based on industry comments, certain technical and cost models for the refining industry have been revised. A proposed rule for gasoline volatility was published in 1987.

A second action aimed at ozone reduction is control of refueling emissions. The EPA expanded its efforts in 1986 with an analysis of whether refueling emission controls are necessary, whether the control should be at the gas station or on the vehicle, and development of a refueling test procedure based on industry comments and a computer model of the refueling system. A proposed rule was published in 1987, along with the gasoline volatility proposal.

A third ozone-related action is the tightening of light-duty truck exhaust hydrocarbon standards. An advance notice of proposed rulemaking was released in 1986.[1] Continued rulemaking activity is expected.

C. AIR TOXICS

Three initiatives on air toxics were related to vehicle fuels:

- In 1986 EPA prepared a study of costs and benefits in reducing the amount of sulfur in diesel fuel. Reductions of sulfur and the aromatic content of diesel fuel may lead to significant reductions in potentially toxic particulate emissions from diesel engines. A comprehensive study on diesel fuel sulfur was published in 1987. A decision on whether to pursue rulemaking is expected by the end of 1987.
- Development of testing protocols was begun to determine the health effects of fuels and fuel additives. An inventory of current commercially available fuel additive materials was developed and an Advance Notice of Proposed Rulemaking was prepared for publication in 1987.
- An internal workshop on formaldehyde exposure was held in 1986 and work was recommended for 1987.

The EPA also has responsibility for enforcing section 211 of the Clean Air Act relating to the regulation of fuels and fuel additives. One of the regulations under this section is aimed at protecting the catalytic converters on 1975 and later model year cars. The EPA has established a nationwide fuels enforcement program to ensure that affected retail outlets comply with these regulations. This program includes sampling of the fuel at retail outlets by EPA field inspectors and private or State inspectors under EPA contract in order to measure the fuel's lead content. The EPA conducted 15,000 inspections under this program during 1986.

The EPA's promulgated rule which reduced allowable lead in gasoline from 1.1 grams per leaded gallon to 0.1 gram per leaded gallon took effect January 1, 1986.[2] As a result of this rulemaking, actual lead used was reduced considerably in 1986. About 10 billion grams of lead will have been used; this is a 95 percent reduction from the 200 billion grams used in the mid-1960's. During 1986, in accordance with the Food Security Act of 1985, EPA conducted tests of farm machinery run on leaded, no-lead, low-lead, and additive gasoline. This testing sought to assess the degree of premature wear in engines built to use leaded gasoline exclusively. In 1987, EPA will report to Congress findings concerning this study.

The EPA Mobile Source program has substantially shifted its enforcement efforts into this area during 1986 by instituting a fuel refiner/importer audit program to assure compliance with the lead phasedown regulations. Investigation and enforcement in this area involve extensive analysis of the production, importing and blending of gasoline, gasoline blendstocks, and lead additives. The EPA also tracks the banking and withdrawal of lead rights and related documents and records. The EPA has successfully conducted a number of these audit-type investigations. Computer programs have been developed to help analyze the refiners' records and a strategy is presently being developed to integrate and evaluate all sources of data available (i.e., EPA, Department of Energy, Customs Service, etc.) to identify potential refiners and importers for investigation. The EPA conducted investigations of 11 refiner facilities during 1986 and several Notices of Violation have been issued with proposed penalties of over $40 million. Future cases of this type will likely involve significant violations with proposed penalties in the multi-million dollar range.

In anticipation of the elimination of lead in in-use fuel, EPA proposed elimination of lead in test fuel.[3] This will mean that manufacturers of engines not requiring catalysts, such as certain heavy-duty gas-powered engines, must meet emission standards using only unleaded gasoline. A final rule is expected in 1987.

In 1986, the Fuel and Fuel Additive Registration System was transferred from EPA's Office of Research and Development to EPA's Office of Air and Radiation. This registration function assures that EPA is knowledgeable about the chemical content of fuels and fuel additives. In conjunction with EPA's development of test protocols for assessing health effects, it will enable EPA to assure that proper restrictions are placed on substances which cause harm to the environment and/or public health. Further, the registration system permits EPA to better monitor the compliance of fuel and fuel additive manufacturers with the requirements of section 211 of the Clean Air Act concerning waivers for new fuels or additives.

D. STANDARD SETTING

With the achievement of effective tightening of passenger car standards, EPA has increasingly turned its regulatory focus toward the development of parallel standards for heavy-duty trucks and other commercial vehicles. Projections indicate that these vehicles will contribute an ever-increasing percentage of the mobile source emissions generated for the rest of this century.

Accomplishments in this area during 1986 include the following:

- In anticipation of the development of methanol as an alternative fuel, a Notice of Proposed Rulemaking was published in 1986 proposing emission standards for methanol-fueled vehicles.[4] Methanol has the potential to reduce hydrocarbon emissions from gasoline engines and particulate emissions from diesel engines. A hearing was held to solicit public comments, and a final rulemaking is planned for the spring of 1988.

- EPA defended the March 1985 heavy-duty diesel engine rulemaking[5] in court. Environmental groups believed the standards were too lenient, while manufacturers believed the standards were too strict. The court upheld most aspects of the promulgatd standards but required that the effective date of certain standards for oxides of nitrogen be delayed for 2 years.

- EPA continued to promulgate nonconformance penalties for those engine families unable to meet certain standards applicable to a given model year. This mechanism assures that no manufacturer benefits financially from nonconformance, and that the least effective technology does not determine the stringency of standards for the entire industry. Rulemaking proposals for 1991 and later light-duty diesel truck particulate emissions, and 1991 and later heavy-duty diesel engine particulate and oxides of nitrogen emissions are planned for 1987.

- EPA also published a study on the economics of trading and banking emissions of particulate matter and oxides of nitrogen from heavy-duty diesel engines in 1986.[6] After consideration of public comments, EPA may make further trading and banking proposals in 1987.

- The EPA incorporated newly received emissions data into a study of railroad emissions which it has been conducting. The complete study is scheduled for release in 1987.

E. PREPRODUCTION COMPLIANCE

One of EPA's key techniques for assuring the compliance of vehicles with the motor vehicle emissions standards is the preproduction certification program. Initiated in 1968, the program involves the engineering review and testing by EPA staff of engine families representing new vehicles which are to be sold in the United States. This process includes the submission of technical data from manufacturers about prospective production vehicles, emissions testing of prototypes by manufacturers, a review of engineering data and test results by EPA personnel, and, in certain cases, confirmatory testing of prototypes at EPA's National Motor Vehicle Emissions Laboratory in Ann Arbor, Michigan. This procedure identifies and resolves potential problems which could result in excessive in-use emissions. Correcting these problems at the preproduction stage assures maximum environmental benefits and reduces compliance cost to the industry compared to correcting the problems when discovered in use.

The certification program is the only vehicle emission compliance program which evaluates all vehicle designs from each manufacturer. It is also the only program which screens vehicles for elements of design known as defeat devices. A defeat device allows a vehicle to pass emission standards when tested according to Federal test procedures but produce unacceptably higher emissions when operated under other conditions. Coupled with the Selective Enforcement Audit and in-use compliance test programs, the certification program provides the necessary oversight to assure vehicles are adequately designed and constructed for satisfactory in-use emissions performance.

As a result of a series of regulatory reforms implemented over the last several years, the certification process has become a much stronger, flexible, and more efficient program. Effective use of computerization has eliminated redundancy, resulted in administrative streamlining and eased the procedural burden to the manufacturers, while still retaining the full effectiveness of the program.

The current emphasis is on assuring maximum in-use benefit from the preproduction certification program. This emphasis includes three parts: (1) careful monitoring to confirm full compliance with existing regulation; (2) in-use vehicle testing to quantify the level of emissions performance deterioration between the preproduction prototype vehicle certification test results and actual in-use vehicle emission performance; and (3) identification of potential certification program changes to improve cost effectiveness.

F. VEHICLE INSPECTION PROGRAM

An effective strategy for dealing directly with in-use emissions problems is the establishment of motor vehicle I/M programs. EPA's basic approach in this area was determined by the 1977 amendments to the Clean Air Act. Urban areas of the country which obtained an extension in the deadline for attaining the ambient air quality standards for automotive-related pollutants beyond 1982 are required by the Clean Air Act to implement an I/M program. In 1986, EPA continued to promote the implementation of I/M programs in each locality where it is required by the Clean Air Act. By the end of the year, 58 of 62 areas had initiated I/M programs.

To assure that operating I/M programs actually achieve the planned emissions reductions, EPA has initiated a systematic I/M auditing plan. In 1986, EPA audited 13 inspection and maintenance programs and conducted six follow-up audits. Auditing and thorough follow-up by Federal, State, and local officials will pinpoint and lead to correction of any major deficiencies in individual I/M programs.

In addition to I/M programs, EPA has promoted the implementation of State and local antitampering enforcement programs. By the end of 1986, 32 programs had been implemented. These 32 programs include five statewide programs which cover 13 post-1987 nonattainment areas.

G. MOBILE SOURCE ENFORCEMENT

The EPA mobile source enforcement program is directed primarily toward achieving compliance with motor vehicle emissions standards and fuel regulations as required by the Clean Air Act. The major goals and objectives are to: (1) assure that both new and in-use vehicles meet emissions standards; (2) assure that emissions control systems are not removed or rendered inoperative; (3) assure that harmful additives are not present in gasoline; (4) administer statutory and California emissions standards waivers; and (5) administer the statutory emissions warranties.

To accomplish these goals, EPA maintains a number of basic motor vehicle enforcement programs:

Selective Enforcement Auditing

In order to assure that production vehicles and heavy-duty engines are built in accordance with emissions standards, EPA conducts Selective Enforcement Audit (SEA) test programs at manufacturers' facilities. The SEA program is a highly leveraged one. For every car EPA requires manufacturers to test during an audit, over a hundred cars are voluntarily tested by auto producers to assure that the audits do not result in a failure which could affect vehicle production. Since this close scrutiny by manufacturers results in the repair of vehicle classes that are only marginally meeting requirements, EPA has been able to reduce the number of audits it requires. In 1986, EPA conducted 17 SEA's, including four at foreign manufacturers' facilities. The first SEA's of heavy-duty engines were conducted in 1986. These audits were preceded by thorough inspections of the manufacturers' testing facilities to assure adequate procedures were in place and that testing equipment was ready.

Recall Program

Section 207(c) of the Clean Air Act authorizes EPA to order the recall of vehicles if a substantial number of any class of vehicles do not conform to emissions standards during their useful lives. During 1986, a total of 1,012,000 vehicles were recalled either by direct order of EPA or as a result of an EPA investigation. In the same period, manufacturers voluntarily recalled 569,000 vehicles to correct emissions problems. The EPA conducted a total of 28 recall investigations in 1986, and performed 635 tests of in-use vehicles at laboratory facilities in Springfield, Virginia, and Ann Arbor, Michigan.

The recall program has traditionally focused on light-duty vehicle exhaust emissions. However, as new categories of emissions come under stringent control, the recall strategy must be applied to them. Therefore, in 1986, EPA performed a significant number of tests to monitor evaporative emissions from passenger cars and tested several classes of in-use light duty trucks to determine whether they continued to comply with the stringent standards to which they were built.

Fuels Enforcement Program

As mentioned before, rules expediting the lead phasedown schedule took effect as part of EPA's air toxics control effort in 1986. These rules are creating a demand for other additives which may have a harmful impact on auto emissions. The EPA expects that the proliferation of additives will create a need to monitor the composition of vehicle fuels even more closely than in the past.

In a related area, EPA reconsidered and revised restrictions on a fuel additive regulation's waiver for a methanol blend in 1986. This is expected to become an increasingly important area in response to the ongoing lead phasedown program, as refiners experiment with various additives as substitutes for lead in vehicle fuel.

Tampering/Fuel Switching

The EPA is also responsible for carrying out programs designed to deter tampering with vehicle emissions control systems or using leaded fuel in vehicles which require unleaded fuel. Surveys undertaken by EPA have shown tampering and fuel switching to be continuing serious problems which undermine the emissions control performance of many in-use vehicles. The 1985 Motor Vehicle Tampering Survey indicates that about 20 percent of the vehicle fleet is subject to gross tampering, and about 10 percent to fuel switching. Tampering enforcement activities increased in 1986, resulting in 73 notices of violation with proposed penalties of $1.4 million. Similarly, EPA settled a total of 352 fuels and tampering cases during the year for total penalties of $1.4 million.

A critical element of State and local tampering inspections is the availability of replacement emission control components. The EPA published an interim and proposed enforcement policy for new and used aftermarket catalytic converters. This policy gives specific criteria which must be met by all manufacturers of new and recycled catalytic converters. The primary purpose of this policy is to ensure that converters would be available in the aftermarket at a reasonable cost, yet would still provide significant emissions reductions.

Emission Warranty Enforcement

The EPA is also responsible for assessing whether the Federal emission warranty requirements of sections 207(a) and (b) of the Clean Air Act are implemented. During 1986, EPA responded to a total of 1,175 inquiries. Of these, 188 were complaints specifically related to warranty coverage and were referred to the appropriate vehicle manufacturer for resolution. A pamphlet outlining the 207(b) performance warranty was printed and made available to State and local I/M programs.

H. IMPORTS

The control of emissions from imported vehicles has become a major issue in recent years. Due to the desire for luxury imported cars and the strong dollar throughout most of this decade, the importation of cars which do not conform to applicable air pollution control regulations increased from 1500 in 1980 to a high of 68,000 in 1985. In 1986, EPA received 36,500 applications and 32,700 inquiries concerning these automobiles. The EPA believes the decrease in imports from its 1985 peak is largely attributed to the dollar's decline in exchange value in foreign markets, rather than a change in consumer taste. The EPA has substantially automated the processing of applications and test data for cars which have been modified for compliance with emission standards. In 1986, EPA moved forward on revising its regulations controlling these automobiles with the goal of streamlining the process of testing and certification to demonstrate compliance with Federal emission requirements. A final rule is expected to be published in 1987.

The EPA has also been investigating various laboratories to ensure that nonconforming imports have been tested properly to demonstrate conformity with U.S. emissions standards. These laboratories are required to conduct a Federal test procedure and submit the results to EPA for approval. Some laboratories, however, have been falsifying the results of these tests. In 1986, EPA successfully prosecuted a laboratory, resulting in three individual convictions and one corporate conviction. In addition, at the end of 1986, there were three more ongoing investigations which may result in prosecution.

I. LITIGATION

Fuels Enforcement

On June 18, 1986, a U.S. District Court in Kansas City, Missouri, imposed a judgment for $160,000 against a corporation for a violation of section 211 of the Clean Air Act. The case is significant since it awarded per-day penalties for each and every day of the continuance of the violation. In addition, Federal District Court cases were initiated against seven defendants in Houston, Texas, for distributing leaded gasoline as unleaded. The U.S. is requesting $10,000 for each violation.

Lead Phasedown

Quarterly reporting of lead usage is required by EPA of all refiners of gasoline. On April 11, a Federal grand jury in Houston handed down an indictment against two employees of an independent refiner charging each with a single count of criminal conspiracy and four counts of knowingly submitting false lead additive reports to EPA in violation of Title 18 of the United States Code. In May 1986, EPA proposed a $2,573,090 penalty against the refiner. The EPA alleged in the notice that the refiner exceeded the allowable lead limits during 5 calendar quarters from October 1, 1983, through December 31, 1984.

Tampering

The EPA, in separate violation notices, cited 16 repair facilities in Indiana, New York, and Colorado for Clean Air Act tampering violations by allegedly removing catalytic converters from 33 vehicles so that converter replacement pipes could be installed. The EPA also alleges that the manufacturers of the catalyst replacement pipes and six distributors of automobile parts caused the tampering violations to occur by making and selling pipes that were used to replace catalytic converters. The EPA proposed a $147,500 penalty against the manufacturer and a $290,000 penalty against the distributors and installers. Investigations of two other manufacurers of catalytic converter replacement devices are ongoing. A Federal District Court case is pending against a fourth company based in Atlanta, Georgia. These actions mark the first time EPA has proceeded with cases based on the "causing" language of section 203 of the Clean Air Act.

In the Federal District Court for the Northern District of Georgia, EPA successfully prosecuted a muffler repair shop for the removal of catalytic converters on 14 vehicles. Penalties of $1500 per violation were awarded by the court. This was the highest dollar amount per violation in a section 203 case ever awarded by a Federal Court. This case is also significant because the court stated that the shop owner was jointly and severally liable along with the company. Court fees were assessed against the defendant as well.

J. REFERENCES

1. 51 FR 32032 (August 8, 1986)
2. 50 FR 9386 (March 7, 1985)
3. 51 FR 24614 (July 7, 1986)
4. 51 FR 30984 (August 29, 1986)
5. 50 FR 10606 (March 15, 1985)
6. 51 FR 31959 (September 8, 1986)

X. STRATOSPHERIC OZONE PROTECTION

A. DESCRIPTION OF ACTIVITIES

The stratospheric ozone layer acts as an important shield protecting human health, welfare, and the environment from harmful solar ultraviolet (UV-B) radiation. The possibility that the production, use, and release of chlorofluorocarbons (CFC's) could cause the depletion of stratospheric ozone was first theorized in 1974. If a net depletion of stratospheric ozone occurred, more UV-B radiation would penetrate to the earth's surface. This could result in a number of possible adverse health and environmental effects. Although less was known about the possible causes and effects of ozone depletion in the mid-1970's, there was sufficient evidence of potential damage to human health, welfare, and the environment to cause the EPA and other agencies to respond to concerns about this issue by promulgating regulations in 1978 limiting the use of CFC's as a propellant in non-essential aerosol spray cans.[1] By significantly reducing CFC use and therefore the risks of ozone depletion, this action provided more time to consider the complex scientific questions involved in addressing those risks.

In 1980 EPA issued an advance notice of proposed rulemaking discussing possible further limits on domestic production of CFC's under section 157 of the Clean Air Act.[2] However, some of the scientific information summarized in that notice was outdated by more recent work in the field, and there have been substantial changes in the research community's understanding of the issue since then. In general, the more recent work demonstrated that possible changes in the stratospheric ozone layer are affected by a more complex array of physical and chemical forces than previously thought. In addition, EPA believes that any decision on further regulation of domestic CFC production or uses should be evaluated in the context of possible international regulatory actions.

The EPA developed a program for further examination and resolution of this issue which it published in 1986.[3] The EPA's Stratospheric Ozone Protection Program integrates the diverse scientific and economic research being carried on by EPA and by other organizations into a framework for future EPA decision making on both the domestic and international aspects of the issue. The three primary elements of the plan are: (1) conducting analyses and research across a range of economic, engineering, health, and ecological subjects aimed at narrowing uncertainties; (2) participating in a series of workshops and conferences both in the United States and abroad aimed at improving understanding of all aspects of this issue; and (3) deciding by May 1987 whether additional domestic regulations of ozone-depleting substances are warranted, and issuing a final regulation by November 1987. The EPA subsequently announced that it had extended its decision timetable until December 15, 1987, for a proposed action and August 1, 1988, for a final decision. A court order requires EPA action by that time.

Key areas of analysis have included the future growth in emissions and concentrations of CFC's and other trace gases, their effect on the stratosphere, the harmful effects of UV-B radiation on human health, welfare and the environment, and the costs and benefits of regulatory actions.

The EPA sponsored and participated in a series of domestic and international workshops that focused on future demand, technical controls, and control strategies for stratospheric ozone-modifying chemicals, e.g., CFC's and organobromines. Future supply and demand for CFC's and other trace gases, and potential control technologies were discussed at a domestic workshop held in Washington, D.C., in March 1986 and a companion international workshop, co-sponsored with the United Nations Environment Programme (UNEP), in Rome in May 1986. An evaluation of various control strategies was undertaken at a domestic workshop in Washington, D.C., in July 1986 and at a companion international workshop cosponsored with UNEP in Leesburg, Virginia, in September 1986.

The effects of trace gases on the stratosphere are summarized in a three-volume international assessment coordinated by the National Aeronautics and Space Administration, UNEP, and the World Meteorological Organization. To consider the effects of UV-B radiation on human health, welfare, and the environment, in June 1986, EPA cosponsored with UNEP the International Conference on the Health and Environmental Effects of Ozone Modification and Climate Change in Washington, D.C. Over 70 technical papers were presented by representatives from 18 nations.

The EPA integrated the results of these analyses in its March 1987 report, An Assessment of the Risks of Stratospheric Modification, which was approved by the Science Advisory Board in March 1987. This assessment will serve as the technical basis for future EPA decision making.

In addition to continued research regarding the potential impact of increased levels of solar UV-B radiation on U.S. agriculture, silviculture, and marine fisheries, work is ongoing on a regulatory impact analysis for possible domestic and international controls on CFC's and other potential ozone-depleting trace gases. These analyses will support later EPA regulatory determinations.

The EPA participation in international efforts to protect stratospheric ozone is proceeding on a parallel track. In addition to its participation in international workshops on CFC demand and control technologies, control strategies, and the effects of UV-B radiation, EPA has assisted the Department of State in international negotiations conducted under the auspices of UNEP. The Vienna Convention for the Protection of the Ozone Layer, ratified by the Senate in July 1986, establishes a framework for scientific and economic research on the stratosphere. The government is currently involved in negotiations under the auspices of UNEP to develop a protocol to the convention which limits the future use and emissions of CFC's.

B. REFERENCES

1. 43 FR 11301, March 17, 1978
2. 45 FR 66726, October 7, 1980
3. 51 FR 1257, January 10, 1986

XI. RADON ASSESSMENT AND REMEDIATION

Radon is a radioactive gas produced by the radioactive decay of radium-226, which occurs naturally in almost all soils and rocks. The Reading Prong area of Pennsylvania, New Jersey, and New York are the best known high-radon areas in the United States at this time. However, indoor radon is potentially a widespread problem as high radon levels have been found in many States.

Initial efforts of EPA Radon Action Program in 1985 were concentrated in the Reading Prong with measurement assistance being provided to States in that area. The program was expanded in 1986 in response to increased awareness of the magnitude of the problem and the associated health risks.

A national strategy was developed to guide EPA efforts in assisting State governments and the private sector in assessing and reducing health risks due to indoor radon. The strategy builds upon existing knowledge and focuses not only on reducing significant current risks, but also on reversing trends in structure design, siting, construction, and maintenance that could increase future risks.

The goals of the EPA strategy are as follows:

1. Determine national frequency distribution of radon concentrations and identify high risk areas.
2. Remediate exposure in existing structures.
3. Prevent exposure in future construction.
4. Provide for limited, yet essential, overall Federal program direction and coordination.

The EPA's Office of Radiation Programs is responsible for coordinating EPA's indoor radon program with Federal agencies and the States. The Radon Management Committee, comprised of senior-level management officials from various headquarters and Regional Offices within EPA, was established and met regularly in 1986 to provide policy advice and identify priority actions for the Radon Action Program.

In 1986, the major program activities for the Radon Action Program included:

1. Providing technical assistance in developing a comprehensive measurement program to ensure consistency and utility of collected data;

2. Reducing radon exposure in existing homes through remediation demonstrations and house evaluation programs;

3. Working with public and private sector organizations to prevent excessive exposure in new homes through development of better construction designs, and identification of criteria for high-risk lands;

4. Providing technical training in measuring and diagnosing radon problems, working in cooperation with States to share technical and other information, and encouraging development of private sector programs; and

5. Disseminating public information on the risks of indoor radon exposure and ways to reduce exposure.

Also in 1986, Congress passed Title IV of the Superfund Amendments and Reauthorization Act of 1986 requiring EPA to formally establish a program for radon gas and indoor air quality. This Act requires EPA to gather data on indoor air pollution; coordinate Federal, State, local, and private research and development efforts; and assess appropriate Federal action to mitigate the environmental and health risks associated with indoor air quality problems. Beginning in 1987, the Act specifies a number of activities which EPA is expected to include as part of its Radon Action Program. These activities include technical assistance to the States, a national assessment of radon levels in structures, and a demonstration program to test mitigation methods.

XII. LITIGATION

A. INTRODUCTION

During 1986 two highly significant precedent-setting cases involving the Clean Air Act were decided by the courts. These are discussed below. Following those cases are discussed a number of others that have significant program implications but are not as broadly significant.

B. LANDMARK DECISIONS

1. Acid Rain Decision: Thomas v. New York

In a major ruling on EPA's obligations under section 115 of the Clean Air Act, the D.C. Circuit held that two letters forwarded by former Administrator Costle in 1981 to the Secretary of State and to Senator George Mitchell did not trigger a nondiscretionary duty on the part of the current Administrator to issue calls for State implementation plan (SIP) revisions in States allegedly contributing to acid deposition in Canada. The court reversed a prior adverse ruling by Judge Norma Holloway Johnson of the District Court for the District of Columbia. The D.C. Circuit denied petitions for rehearing filed by the petitioners, several environmental groups and northeastern States. These parties have since petitioned for Supreme Court review.

2. Overflight Inspection Case: Dow Chemical Co. v. United States

On May 19, the Supreme Court ruled that EPA acted within its statutory authority under the Clean Air Act in inspecting a Dow chemical plant by taking aerial photographs. The case is broadly significant because of its ruling that EPA is free to use this inspection technique without transgressing constitutional guarantees against unreasonable searches and seizures.

C. OTHER SIGNIFICANT DECISIONS

1. Detroit Incinerator Best Available Control Technology (BACT) Decision: Greater Detroit Resource Recovery Authority v. Adamkus

Judge Barbara Hackett of the Eastern District of Michigan issued an order on October 8 enjoining EPA from taking action to withdraw or modify a prevention of significant deterioration (PSD) permit issued by the State of Michigan under delegated Federal authority. The permit authorizes the construction of a large municipal resource recovery facility whose potential dioxin and furan emissions are of serious concern to the Canadians. The court ruled that EPA has no authority to terminate or modify a PSD permit once it is issued except under narrow circumstances.

2. With one significant exception, the courts uniformly rejected challenges to EPA actions in approving or disapproving particular SIP's during 1986. The principal decisions were:

a. Bethlehem Steel Corp. v. EPA (Bethlehem IV), where the Seventh Circuit rejected challenges to EPA's partial disapproval of Indiana coke oven rules. Among other rulings, the court rejected industry arguments that EPA may not require reasonably available control technology (RACT) in nonextension areas after 1982, and denied the citizen groups' request that EPA be ordered to promulgate new and more stringent coke oven rules in nonattainment areas.

b. Michigan v. Thomas (Michigan RACT Case), in which the Sixth Circuit upheld EPA's disapproval of purported RACT requirements for fugitive dust sources, which EPA believed were vague and unenforceable. The court held that EPA was not bound to approve such requirements even though it had earlier done so for other States; the EPA showed that its experience with those other States supported its view that they did not yield RACT-level controls, and should therefore no longer be approved.

c. Council of Commuter Organizations v. Thomas, (New York Carbon Monoxide and Ozone SIP Case), where the Second Circuit upheld EPA's approval of the New York SIP for ozone and carbon monoxide against a citizen group argument that the State had failed to meet the Clean Air Act requirement that the existing transportation system meet "basic transportation needs."

d. New Mexico Environmental Improvement Division v. Thomas, in which the court upheld EPA's imposition of restrictions on air grants to the State Air Pollution Control Agency for failure to submit on adequate inspection/maintenance program for Albuquerque, against a challenge by the State agency mainly on the ground that the formula selected by EPA for apportioning the restriction between the State and local agencies was arbitrary and capricious.

In Ohio v. EPA, however, the Sixth Circuit, ignoring its own precedents to the contrary, overturned EPA's approval of revised sulfur dioxide SIP limits for two power plants operated by the Cleveland Electric Illuminating Company, on the grounds that EPA had failed to verify modeling results against field data. On EPA's petition for rehearing, the court narrowed its holding to reflect its concern that the model failed adequately to account for lakeshore fumigation effects.

3. Polycyclic Organic Matter (POM) Settlement: New York v. Thomas

The EPA settled a lawsuit under section 122 of the Clean Air Act (Listing of Certain Unregulated Pollutants) challenging EPA's decision not to regulate POM. The settlement agreement requires EPA to take a number of regulatory and nonregulatory actions, including conducting a rulemaking under section 111 of the Clean Air Act for wood stoves, and determining whether to list municipal waste combustor emissions as hazardous air pollutants under section 112.

4. Heavy-Duty Vehicle Standards Case: NRDC v. Thomas

The D.C. Circuit largely rejected petitions for review filed by environmental groups and industry challenging the stringency and timing of recently promulgated emission standards for heavy-duty vehicles. The court deferred to EPA's "reasonable" reading of the statute as requiring technology-forcing standards that most manufacturers could meet in the available lead time. The court declined to decide several other substantive issues because the petitioners had not raised the issues in the rulemaking. The court overruled only EPA's promulgation of a nitrogen oxides standard with less lead time than the statute required, finding that the statutory requirement could not be avoided even where EPA had missed the statute's deadline for promulgating the standard and manufacturers required less lead time than the Clean Air Act provided.